# **CURRENT STUDIES IN ENVIRONMENTAL EDUCATION**

EDITORS SINAN ERTEN AYSE CEREN ATMACA AKSOY



# **Current Studies in Environmental Education**

Edited by

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Editors

# Sinan ERTEN Ayse Ceren ATMACA AKSOY

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#### PREFACE

It is not possible for human beings to survive on their own. Human beings have maintained their existence in close relationship with their environment since their creation. He needs his environment in order to continue his existence. In the beginning, he met his compulsory needs from his environment and thus continued his life. However, with the progression of time, their needs and desires have changed and in this context, the way they use their environment has changed. It has used the natural resources of the planet as if they were unlimited resources and destroyed nature. Although the consequences of the destruction of the environment first emerged regionally, over time it started to be seen all over the world. Many problems such as difficulty in accessing clean water, famine, epidemics, global warming, etc., which arise as a result of environmental destruction, have begun to threaten the sustainability of living life and our planet. Environmental problems are global problems that affect all people without discrimination. In this context, every individual living on this planet has a responsibility towards the environment. The most basic way to raise environmentally aware and responsible individuals is to provide individuals with effective and efficient environmental education. With an effective and efficient environmental education, it is aimed to raise individuals who have the right knowledge and skills about the environment, are sensitive to environmental problems, exhibit environmentally friendly behaviors, and adopt environmental protection as a lifestyle. In this context, environmental education should be integrated into all grade levels and courses in curricula. This book has been prepared on the basis of three objectives. The first of these is to witness the past and present of environmental education. In this context, it is to reveal the changes and developments in environmental education. Our second aim is to reveal the current situation of environmental problems and solution studies for these problems. Our third aim is to reveal different perspectives and activities by examining current approaches in environmental education.

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#### **IN THIS BOOK**

*In Chapter 1*, is going to discuss Basic Concepts in Environmental Science and Environmental Education from a Current Perspective to explain what needs to be considered when raising environmentally friendly individuals. The Turkish Ministry of Environment and Urbanization said in a statement it issued about 30 years ago that humanity was at a historic turning point. Poverty, pandemics, lack of education and knowledge, and hunger are all on the rise. This shows that environmental problems are a fundamental issue in the 21st century. We must first talk about ecology if we are to recognize environmental problems and find solutions to them. We then need to adopt a positive stance vis-à-vis the environment and develop environmentally friendly behaviors. This can only be achieved through environmental education.

*In Chapter 2,* firstly the relation between ecological footprint and biocapacity was explained. Ecological deficit increases year by year. Secondly, the role of environmental education and its historical process were explained. Industrialization and usage of fossil fuels increased in the 1960s and 1970s. The United Nations, the first international organization to protect the environment, held its first meeting called The United Nations Conference on the Human Environment in Stockholm, 5 June 1972. The chapter includes the main points of conference reports which were published from 1972 (Stockholm Declaration) to 2022 (Stockholm +50).

*In Chapter 3,* underscores the essential role of early childhood environmental education in forming individuals with heightened environmental consciousness. It explores how initial experiences shape a young person's relationship with their natural surroundings and highlights the responsibility of educators, parents, and caregivers in fostering positive environmental attitudes. The chapter examines the cognitive development of young children, benefits of nature exposure, and effective educational programs amidst a digital society. Recent research demonstrates the significant impact of nature exposure on cognitive development and long-term environmental attitudes. The chapter also addresses the challenges of implementation, emphasizing the importance of inclusivity and accessibility. The chapter offers practical guidance by presenting sample activities that aim to involve young children in experiential learning about the environment. The chapter also emphasizes the importance of stakeholders recognizing their responsibility in promoting environmental stewardship. Furthermore, the chapter suggests that by using insights from early childhood education and research, we can establish a sustainable and environmentally conscious future.

*In Chapter 4*, addresses the place of environmental education in education programs. The achievements for environmental education in primary and secondary education curricula were examined. In particular, science, social sciences, physics, chemistry and biology curricula, where environmental education is much more prominent, were analyzed in detail. It is aimed to reveal the current situation as a result of the acquisitions examined for environmental education.

*In Chapter 5,* environmental education is considered as a transdisciplinary process. Definition, key principles and benefits of transdisciplinary environmental education are discussed; teacher and students roles, assessment, learning environment and content topics are presented. Lastly, sample project ideas and cases are proposed to exemplify implementation of transdisciplinary education.

*In Chapter 6,* defined climate, climate change and other environmental problems. Then, the focus was on the natural causes and human-induced causes of climate change. Evidence has been presented that climate change is a very important environmental problem and

that it has a reciprocal effect with many environmental problems. For this reason, climate change is not only a climate problem, but also its relationship with other environmental problems is an important issue that needs to be examined. Other environmental problems closely associated with climate change are biodiversity loss, water scarcity, land degradation, air pollution, ocean acidification, deforestation, migration and energy use. In order to overcome climate change, it is necessary to pay attention not only to the factors directly related to climate change but also to the environmental problems associated with climate change are biodiversity loss, water scarcity, land the factors directly related to climate change are biodiversity to pay attention not only to the factors directly related to climate change but also to the environmental problems associated with climate change. At this point, climate change is discussed together with other environmental problems and these relationships are defined in this section.

*In Chapter 7*, environmental problems and the search for solutions are explained from a current perspective. To be able to understand environmental issues, we first need to examine the concept of environment. Only in a healthy environment can a living organism continue to live healthily. According to the definition published by the Ministry of Environment and Forestry in 2008, the environment is the physical, biological, social, economic, and cultural setting in which living things meet their needs, maintain their relationships, and interact with each other throughout their lives. The environment, in short, is a system of relationships. Any disruption of this relationship upsets the natural balance.

*In Chapter 8,* the recycling and zero waste approach, gaining great importance by getting into our lives with the waste problem emerging as a result of people's unconscious consumption, is examined. The emergence of the concept of zero waste, the foundations of this approach, zero waste management and its connection with the economy, the role of zero waste in raising environmental awareness and the connection of zero waste with the recycling of waste were explained in order to shed light on the zero waste approach. The zero waste approach and the necessity of recycling as a lifestyle to be environmentally friendly were emphasized.

*In Chapter 9*, focuses on the development and evolution of the concepts of sustainable development and environmental literacy from their emergence to the present day. In the chapter, both concepts are evaluated in the context of their historical development. The chapter presents the main contexts of sustainable development and environmental literacy and examines the relationship between them.

*In Chapter 10*, Sustainable development, sustainable development education, innovative learning, thematic learning, innovative thematic activity examples. Sample activities for science course, Turkish course, mathematics course, social studies course, foreign language course, information technologies and software course, religious culture and moral knowledge course, visual arts course, music course, physical education and sports course, technology and design course.

*In Chapter 11*, the concept of ecopedagology, which emerged as a result of the rapid integration of 21st century skills into our living spaces, is discussed. It is aimed to approach the phenomenon of ecopedagology with a broad perspective by emphasizing the concepts of ecology, ecopedagology, ecopedagological literacy, ecopedagology in the world and in Turkey, which contribute to the emergence of this concept.

*In Chapter 12,* environmental ethics, climate justice, and social justice are examined. This chapter delves into environmental ethics from its origins to its present state. It discusses the importance of ethical principles in defining our connection with nature and addresses challenges within environmental ethics. Moreover, it examines climate justice within its historical context and its connection to global climate agreements, expanding to include social justice. The chapter concludes by reflecting on the evolving landscape of social



justice and the inherent relationship among environmental ethics, climate justice, and social justice. It is aimed to elucidate the intricate relationship between environmental ethics, climate justice, and social justice, highlighting their interplay and significance in shaping ethical perspectives towards our environment and societal equity.

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# **CHAPTER 1**

# **Basic Concepts in Environmental Science and Environmental Education from a Current Perspective**

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#### NATIONAL ENVIRONMENT PREACH

Based on the fact that current and future generations have the right to live in a clean and healthy environment,

Emphasizing that I am in favor of environmentally friendly development,

Knowing that natural resources constitute both the source and limit of economic development,

Believing in the necessity and importance of individual contribution and participation in the protection and development of the environment;

I promise to protect environmental values and warn those who harm them, to be economical when using natural resources, to act in line with the principles of sustainable development, to act in cooperation and solidarity in this direction, and to be an example to everyone regarding the environment.

Süleyman Demirel

President of the time

Hüsamettin Cindoruk

Speaker of the Turkish Grand National Assembly of the time

Prof. Dr. Tansu Çiller

Prime Minister of the time

Rıza Akçalı

Minister of Environment of the time

#### Introduction

The Turkish Ministry of Environment and Urbanization said in a statement it issued about 30 years ago that humanity was at a historic turning point. Poverty, pandemics, lack of education and knowledge, and hunger are all on the rise. Nations have to coexist with many cultural differences at home but these differences also exist on an international scale. Humanity is accelerating the collapse of ecosystems in order to survive. Assessments made of the environment and sustainable development say it might be possible to achieve a more secure future by improving living standards for everyone and protecting ecosystems, but this is only possible through international collaboration. The framework of such collaboration must be based on a global partnership for sustainable development. This shows that environmental problems are a fundamental issue in the 21st century. We must first talk about ecology if we are to recognize environmental problems and find solutions to them. We then need to adopt a positive stance vis-à-vis the environment and develop environmentally friendly behaviors. This can only be achieved through environmental education. This chapter is going to discuss Basic Concepts in Environmental Science and Environmental Education from a Current Perspective to explain what needs to be considered when raising environmentally friendly individuals.

## The Environment

#### **Basic Concepts in Environmental Science**

Many definitions of the environment have been made to date. The basic reason for this is that each culture perceives the word "environment" differently and attributes different meanings to it in a cultural sense. When considered as a concept, the environment can be defined as the biological, physical, social, economic, and cultural setting in which creatures maintain relationships and mutually interact throughout their lives (Republic of Turkey Environment Act, 1983). The related literature includes definitions that emphasize people's relationships and interactions with other people, non-human creatures, and non-living objects (Keles et al., 2009). One example of this is "The environment consists of humans and all other living organisms together with nature and all the elements in nature that affect human life" (Ertürk, 1998). Such definitions distinguish between humans and other living organisms, implying that humans are superior. Modern definitions appear to move away from this anthropocentric approach and instead adopt one that does not separate humans from other living organisms, one that describes man not as the master of the environment but as part of it. Most definitions of the environment describe it as living organisms and their communities and they include all the non-living external conditions that affect them throughout their lives; such definitions also describe all these factors as a whole. One of the first such definitions says, "The environment is all the factors that affect a living organism's development and life." We also see a definition of the environment that puts man at the center and that talks about the natural environment made up of stone, earth, water, and air, the environment made by man that includes houses and vehicles, and the social environment that includes all social relations. Another definition describes the environment as all the biotic and abiotic factors that affect a living being or a group of beings (Erten, 2020; Yıldız et al., 2000). This chapter uses a broader definition of the environment.

The environment is what we call the domain where living organisms and non-living objects interact with one another in equilibrium. The living organisms in this definition comprise producers, consumers, and decomposers. These living organisms are also called biotic factors. The non-living entities are all the physical and chemical conditions such as earth, air, wind, heat, light, and their associated inorganic (elements) and organic matter (nutrients). These are described as abiotic factors. All the living organisms and non-living objects here are what make up the environment. Primarily, the balance between the biotic and abiotic factors needs to be preserved for an ecosystem or environment to function healthily (Campbell, 1997; Erten, 2022; Kiziroğlu, 2004). It is the environment that gives living organisms the means to meet all their physiological needs such as shelter, nutrition, and maintaining their species. The environment has great meaning for all living organisms. Living beings must be at one with the environment if they are to survive (Karataş & Aslan, 2012).

Another concept that should be discussed while explaining the environment is the ecosystem. A review of the literature revealed that the concepts of environment and ecosystem are often used interchangeably. An ecosystem is a natural system that includes the interaction of living organisms with other living organisms and non-living factors, has all the necessary conditions for living organisms to live, has definite boundaries, and can renew itself. In other words, it is a self-contained living environment where living organisms can meet all their needs to live. An ecosystem can be a small pond or a large ocean. Although the concepts of ecosystem and environment are thought to be the same because they both include living and non-living factors, some elements distinguish these two concepts from each other. The boundaries of the ecosystem are defined, whereas the environment refers to a large area, including ecosystems. It includes small wetlands and vast oceans alike, in short, everywhere and everything that harbors living organisms (Yıldız et al., 2000).

#### **Environmental Science**

Environmental science, also known as ecology, is a sub-branch of biology. Environmental science examines the relationships of living organisms with themselves and their surroundings. In a broader definition, environmental science is the branch of science that examines the relationships and interactions of living organisms with living and non-living factors, the cycles of matter and energy that ensure the continuation of life, and the units of space that can renew themselves (Campbell, 1997; Erten, 2004; Kiziroğlu, 2004; Yıldız et al., 2000). The emphasis on living in this definition means all organisms in the realm of the living. Environmental science investigates both the positive and negative interactions of living organisms with living and non-living elements (Erten, 2004).

The history of environmental science tells us that Ernst Haeckel was the first scientist to use "ecology" as a concept. Haeckel provided a broad definition of ecology in 1869: "It is the science that investigates all the relationships of living organisms among themselves and with the organic and inorganic environment they are in." According to this definition, ecology is a sub-branch of biology and has much in common with other sub-branches such as genetics, anatomy and physiology, evolution, and behavioral science. Although this definition was criticized by the scientists of the time for addressing such a broad scope, the subject area of ecology did not lend itself to a narrower definition. This is why ecology was treated as a separate branch of science in the 1970s when

environmental issues came to the fore on a global scale even though it had been regarded as a sub-branch of biology until the 1960s. At the root of this lie both the concern that environmental problems will now make the world uninhabitable and the effort to find a solution to these problems (Erten, 2004).

Although ecology seems to have been defined in the 1800s-1900s, it is a much older branch of science. Even before Haeckel's description, scientists knew that living beings interacted among themselves and with non-living factors. Aristotle's definition "The universe is a whole, the elements that make up the universe transform into each other with an endless cycle of matter, living organisms have adapted to the environment they live in, they interact with each other and their environment, and at the same time they are in a struggle to live" is proof that this knowledge existed about 400 years ago (Yıldız et al., 2000).

#### **Biotic Elements**

Biotic elements; It will be explained under three headings: procuders, consumers and decomposers.

#### **Figure 1.** *Biotic Elements*



#### Producers-Autotrophs- Organisms That Produce Their Own Food

The basic building block of all life is cells, the smallest living unit of structure. Cells are a system in themselves and need energy to function. The source of this energy comes directly or indirectly from the sun. Organisms that synthesize organic compounds from inorganic compounds using solar energy through photosynthesis are producersautotrophs. They produce their own food.

#### Consumer- Heterotroph- Organisms That Do Not Produce Their Own Food

Consumers get the food they need to meet their physiological needs from the producers. Animals, fungi, and bacteria are almost all consumers. Plant eaters/herbivores use plants as their only source of food, and meat eaters/carnivores use animals as their only source of food. Those that eat both plants and animals are called omnivores.

#### 1.1.3.3. Decomposers

This group consists mainly of fungi and bacteria. The creatures in this group feed on all kinds of waste and also play a part in matter cycles. Decomposers destroy all animal and vegetable waste from fallen leaves to carcasses.

#### **Abiotic Elements**

Abiotic elements are all physical and chemical conditions such as soil, water, air, wind, temperature, light and, accordingly, inorganic (elements) and organic substances (nutrients). In this book chapter, air, water, soil, light and temperature will be explained in detail.

## Figure 2.

Abiotic Elements



#### Air as an Abiotic Element

An abiotic element, air is vital as it carries the oxygen that living organisms need to breathe. Oxygen makes up 21 percent of air. Of the remainder, 78 percent is nitrogen, 0.03 percent is carbon dioxide and 0.97 percent is other gases. Carbon dioxide is another important gas for living organisms because it forms the basis of photosynthesis and is thus indispensable for the life of producers. The oxygen generated by the producers through photosynthesis is needed for all living organisms to breathe. The producers need the carbon dioxide generated by the consumers so they can perform photosynthesis. The producers need the inorganic abiotic elements used by decomposers and mixed into the soil to continue living. This example clearly shows the balance in the environment being discussed here. Meddling with any member of this order will upset the entire balance (Erten, 2019).

#### Water as an Abiotic Element

Waterless environments cannot harbor life. Water makes life possible. The Earth is a planet of water. However, only around 3.6 percent of this water can be drunk, and a substantial proportion of this is found at the poles. Currently, only 0.26 percent of all potable water is available (T.R. Ministry of Environment and Urbanization, 2018). Pollution and squandering of these resources result in droughts and a fall in water quality. Humanity faces a huge risk of drought in the near future. Furthermore, pollution reduces the number of living organisms in seas, rivers, and lakes and adversely impacts the diversity in this ecosystem. Another major problem is waters with increased heavy metal content because these substances accumulate in the adipose tissues of the creatures that live in these waters and reach humans via the food chain. Mankind must develop environmentally friendly behaviors that will be the solution to all environmental problems (Erten, 2019).

#### Earth-Soil as an Abiotic Element

Earth, or soil, is where many creatures live and feed. This is particularly the case for plants as this is where they cling on using their roots and intake water and minerals. Soil pollution, the destruction of forests, erosion, and excessive use of chemicals and fertilizers all affect the balance within the soil itself. This change in the structure of soil directly affects all life because even in a very small area of agricultural soil, we can talk about there being tons of organisms such as bacteria and fungi. One of the most damaging practices to soil and agriculture is undoubtedly the use of pesticides. Pesticides are chemicals used to destroy agricultural pests. These chemicals become part of the food chain, adversely impacting biodiversity and affecting not only agricultural pests but also many beneficial creatures. Another practice is to burn stubble. After stubble fields are burned, it mixes with the soil and acts as a fertilizer for the soil and at the same time enables the soil to absorb rainwater more easily. It also prevents erosion (Erten, 2019). We must avoid all these if we are to protect the soil.

#### Light as an Abiotic Element

Light prompts many behaviors such as migration, growth and development, reproduction, and photosynthesis in particular. Creatures need light to survive (Erten, 2019).

#### Temperature as an Abiotic Element

The Sun is the source of temperature on the Earth. Temperature plays an important role in many vital activities in living organisms, particularly for the functioning of enzymes. Temperature plays a major role in meeting the physiological needs of warmblooded and cold-blooded animals (Erten, 2019). Temperature is one of the climatic and environmental conditions and also affects living organisms, which are biotic factors.

#### Relationship of Biotic Elements with Each Other and with Their Environment

Examples of the communication and interaction we see in nature include an animal eating a plant, trees growing deeper and larger roots to reach down into the nitrogen-rich soil, and mistletoe sinking its roots into the body of the tree that hosts it so

it can feed. In each case, the two organisms interact with each other differently. These can be listed as positive, negative, and neutral. Some types of interactions, their effects on organisms, and corresponding examples are summarized in the table below (Erten, 2019).

#### Table 1.

	1st effect	2nd effect	Example				
	type	type	Example				
Competition	Negative	Negative	Regardless which one wins, two mammals				
	(-)	(-)	fighting over prey lose energy and risk injury				
Marta aliana	Positive	Positive	A bee fertilizes flowers while feeding				
Mutualism	(+)	(+)					
Predation	Positive (+)	Negative (-)	Fungal growth on the branch of a tree. Although				
			all the fungus's needs are met by the tree, the tree				
			itself gets sick and damaged.				
	Positive (+)	Neutral (0)	Growing an orchid on a tree does not affect the tree				
Commensalism			either positively or negatively. The tree supports				
			the growth and development of the orchid.				
Amensalism	Nagativa	Neutral	The toxic substances secreted by the roots of				
	(-)		Hieracium pilosella (mouse-ear hawkweed)				
		(0)	inhibit the growth of the annual plants around it.				
Neutralism	Neutral	Neutral	The presence of two insects that live on the same				
	(0)	(0)	plant and have no effect on each other.				

#### Relationship of Biotic Elements

#### **Negative Interaction**

Negative interactions are based on energy consumption. The negative effect could also be that a snake eats a mouse or that another mouse has to relocate after consuming all the food in the immediate vicinity. Such interactions are divided into three: *competition, predation, and amensalism*.

**Competition** exists in all organisms and harms the entire organism in competition. There are winners and losers among the creatures in competition. The winner will spend more energy than the other to be the winner in this interaction (Allan & Johnson., 1997). This is the downside for the winner. The downside for the loser is losing the conflict. Creatures that live together use common resources in that environment to meet their own physiological needs. These resources are limited and not enough for all the living organisms. This is what lies at the heart of competition. These resources can be food, mate selection, or suitable habitat. It is seen not only in animals but also in plants. The use of sunlight and the effort to spread seeds to larger areas are examples of competition between plants. *Amensalism* is competition in plants. Plants can release toxic substances into their environment and remove other species from their surroundings to thrive. *Predation* is a type of negative interaction based on the relationship between prey and predator. It is based on the strong influencing the weak, thus ensuring the population

balance between the hunter and the prey. Although it seems to be harmful, it is actually useful in that it culls off the weak and sick individuals in populations. This means that future generations will have a stronger genetic makeup (Erten, 2020; Molles & Tibbets, 2002).

#### **Positive Interaction**

Collaborations between and within species are also quite common. Symbiosis is when one living organism's entire life cycle, or a significant part of it, takes place with the help of another living organism. Both organisms benefit the other in this kind of cooperative relationship. When both organisms benefit, this is called mutualism. If one party benefits while the other sees no positive or negative effects, this interaction is known as commensalism (Erten, 2020; Molles & Tibbets, 2002).

#### Neutralism

Relationships in which living organisms are not affected positively or negatively during their interactions. This is frequently seen in interspecies relations because organisms living in the same ecosystem often encounter each other (Erten, 2020; Molles & Tibbets, 2002).

#### **Environmental Issues**

The concept of environment is predicated on organisms living in balance with all the living and non-living factors around them. This balance explains interactions taking place in harmony with these factors. It is because of this that organisms can continue to exist and develop throughout their lives. This ecological balance in nature allows this state to continue as long as there is no external influence. This balance is only disrupted as a result of unthinking meddling from the outside (Görmez, 2003). The disruption of this balance results in many of the problems we face today. Many unexpected weather events in almost every part of the world are related to these problems. Examples include heavy rains, floods, landslides, severe wind events such as tornadoes, hurricanes, and typhoons as well as scorching summer heat, droughts, and forest fires due to the rise in temperatures. In short, these problems, which are defined as environmental problems, are all factors that adversely affect the interactions between living and non-living factors and their continuing mutual relationship in a state of balance (Erten, 2004).

We must first discover the reasons for these problems if we are to find solutions to them. Scientists agree that the most important cause of environmental problems is human behavior (Sciama, 2007). One such behavior is human beings using natural resources unthinkingly for their own wants and endless needs. This is because human beings see themselves as superior to nature. Yet, man is only one of the living organisms in the definition of the environment and is as important as other living organisms. In a system where other living and non-living organisms are harmed or destroyed, man too, cannot continue to live. Harm to all these factors will adversely affect all the conditions necessary to maintain life on this planet.

The consequences of the Industrial Revolution accelerated the destruction of

nature. As the population increased, so did consumption and the need for food and shelter. Consumption and the need for food and shelter continued to increase with the population. This led to increased exploitation of limited surface and subsurface resources to meet people's unlimited needs. With their needs easily met, people continued to increase the world's population as prosperity increased. Another factor in population growth is advancements in medical science. These advances have found solutions to many fatal diseases, prolonging human life as a result. The same is true of major outbreaks. Other variables that affect population numbers are advances in technology, increases in food, and fewer large-scale conflicts and wars. Although they may appear to be very positive developments, they negatively impact the carrying capacity of ecosystems and destroy nature. Some of the main environmental problems we face as a result of all this together with their causes and consequences are explained in the following table. **Table 2.** 

Environmental	Causes	Results			
Problems	Causes				
Air pollution	Fossil fuels, burning garbage,	Acid rain, global warming, damage to			
	radioactive rays	the ozone layer, smog formation			
Water pollution	Excessive fertilization, uncleaned domestic and industrial wastewater, tanker accidents, chemicals, all wastes dumped into the seas	Pollution of rivers, mass deaths of sea creatures, contamination of drinking water, increase in epidemic diseases			
Soil pollution	Garbage and garbage heaps, acid rain, fertilization works, pesticides	Increasing heavy metal concentration in the soil, changing the pH value of the soil, becoming a source of pathogens, deteriorating aesthetics			
Extinction of animal and plant species	Acid rain, plundering of rainforests, monoculture agriculture and forestry, direct destruction of plants and animals, pesticides	The disappearance of many plant and animal species, the destruction of forests, and the constant increase in natural disasters due to climate change			
Changing climates	Destruction of tropical rainforests, unlimited consumption of fossil fuels, use of FKC gases	Formation of the greenhouse effect (Global warming), harmful rays reaching the earth, that is, living things, from the ozone layer			
Garbage Problems	Being a consumer society, use and throw away, wastefulness, inadequate use of waste, lack of education	Resources have reached the point of depletion, underground and surface waters have become unusable due to pollution, and soils have become inefficient due to pollution by harmful substances resulting from garbage			

Causes and Results of Environmental Problems (Erten, 2004)

Examples of environmental problems include air, water, and soil pollution, loss of biodiversity, plants, and animals becoming endangered or on the verge of extinction, global warming, ozone depletion, acid rain, and the climate crisis. The climate crisis

stands as one of the most pressing environmental problems. This is why the climate crisis was treated as a major problem at all meetings on environmental problems from the Rio Convention in 1992 to the Paris Agreement in 2015. The most important characteristic of these problems is that they are global problems that concern all of humanity regardless of gender, socioeconomic and sociocultural status, race, belief, language, or age and they adversely impact all life (Erten, 2004; Erten, 2019; Escobar, 1995; Nag & Vizayakumar, 2005; Rees, 1995). The first definition of environmental problems was made in the 1960s. Developments in the field of industry and technology in Europe, particularly in the 19th century, have made environmental problems an important problem in Europe and in other countries that will affect the whole world in the future (Görmez, 2015). Societies must first be made aware of environmental problems if solutions to them are to be found. Only by making societies aware will it be possible to conserve natural resources and create the desire to make the planet a more habitable place. Research shows that individuals are aware of the environment and its problems. The most important problem encountered in this context is the failure to develop a positive attitude toward this topic and adopt environmentally friendly behaviors. This shows that the knowledge societies have does not equate to the level of consciousness needed to find solutions to environmental problems. This is where environmental education comes into play.

# Environmental Education from a Current Perspective

#### **Environmental Education and Environmental Awareness**

Every person learns continually throughout their life. Desirable or undesirable behaviors continue to develop as learning continues. The concepts of humanity and learning are the basis of direct education. Education is a process that aims to furnish people with attitudes and behaviors that will contribute to society. Education can thus be examined from two perspectives, namely, society and the individual. In the context of the individual, education is based on changes in a person's behavior. In the context of society, it is the process of transferring accumulated knowledge and experience from one generation to the next (Sabancı, 2016). It also has a responsibility to society for how people behave. If education is the process of steering behavior in the desired direction, environmental education is also an important tool for developing environmental problems. Environmental education is thus an important tool for solving environmental problems and raising environmentally conscious individuals by instilling environmentally friendly behaviors (Figure 3).



#### Figure 3.

Environmental Problems, Environmental Education, Relationship Between Individuals with Environmental Consciousness (Erten, 2020)



Environmentally aware individuals are those who champion environmental problems and seek solutions, follow up-to-date information about the environment, and act to protect the environment (Smith, 2009). The main components of environmental awareness are environmental knowledge, a positive attitude toward the environment, and environmentally friendly behavior. Environmental education is a transdisciplinary process that teaches individuals these three basic components (Erten, 2019). Raising ecology-literate individuals is the goal of education today. In addition to possessing environmental knowledge, a positive attitude toward the environment, and adopting environmentally friendly behaviors, these individuals are also aware of sustainable development. They know that a habitable planet is the best legacy they can leave to future generations. They are aware of the rules and limits of the environment. They have the knowledge required not to disturb the balance of the environment. They see themselves not as superior to the environment, but as a part of it. They are aware of their dependency on the environment to meet all their needs to continue living (Harrison, 2010). Since instilling all these changes in students is not a simple and linear process, teachers need to have a thorough understanding of the theory underpinning environmental education. Students should first be taught about phenomena, events, concepts, and relationships regarding the environment. Students will develop positive feelings toward the environment as their knowledge of ecology increases. Students should be supported with instructional activities at this time to develop a positive attitude. After raising students who feel happy when they protect the environment and sad when they see the devastation caused by environmental problems, there is one last step to achieve environmental awareness. This is transforming the students' positive attitude into behavior. Students who act to protect the environment, who save, consume conscientiously, use public transport, and recycle



are said to have adopted environmentally friendly behaviors. This is the main purpose of environmental education (Ağyar, 2014). To summarize, it consists of four dimensions, namely, environmental awareness, environmental knowledge, attitude toward the environment, and environmentally friendly behavior. Environmental knowledge includes all existing information about living and non-living factors, the relationships between these factors, environmental problems, and nature. Attitude toward the environmental problems. Environmental problems. Environmental problems. Environmentally friendly behaviors are all behaviors that aim to protect the environment (Erten, 2004, 2019; Yüzüak & Erten, 2018).

#### Figure 4.

Environmental Awareness Dimensions (Erten, 2020)



As mentioned earlier, developments in industry and technology raise many problems. These problems affect all humanity. Unplanned urbanization, a problem introduced by increasing populations, affects children in particular. Today, children live their lives disconnected from nature. Also, with the development of technology, most children have to choose digital games over outdoor games. As a result, children do not know natural life. People who do not know nature will not make any effort to protect it. This is why the new generation appears to be a stranger to nature with little knowledge of environmental awareness and environmentally friendly behavior. The destruction of natural areas and over-urbanization are among the principal important reasons for this. Another reason is the lack of environmentally friendly curricula (Erten, 2004; Kahyaoğlu, 2016; Karataş & Aslan, 2012). This can be addressed by applying environmentally friendly teaching activities in environmental education. Environmental education appeals not only to the cognitive domain but also to the affective and psychomotor domains. This is why researchers and teachers need to design teaching activities with contemporary

educational approaches, including different learning environments such as out-of-school settings. This will increase students' physical and psychological communication alike.

### **Environmentally Friendly Activity Examples Activity 1-Lighting**

*Purpose of the activity:* The purpose of this activity is to ensure that students acquire energy saving behavior in order to raise environmentally conscious students. In order to achieve this goal, students must first gain awareness about the cost of the energy they spend at school.

**Description:** In order to save electricity, it is important to know how much each electrical appliance costs while operating. For example, every student has heard that they should turn off unnecessary lights that are left on. So, what does it cause when it remains open? What does this mean? It is a necessity to think about this issue and discuss it based on existing data.

#### Activity steps:

1. Students will be divided into groups of 3 or 5 people, considering the class size. Students will be given the following worksheet.

2. Each group will be given a classroom, teachers' room, tea house, principal/deputy principal's room to examine.

3. Student groups will be asked to collect data and fill out the worksheet in the classroom, teahouse, teachers' room, principal/deputy principal room they are responsible for.

#### Worksheet

Answer the questions below.

1. More than half of the energy used in most buildings is for heating. In addition, energy is consumed for lighting. Where are the places where lighting is provided in our school building?

2. Are there places in our school building with too much or too little light? What do you think of overlighting?



3. Is it possible to turn off unnecessary lights and leave the necessary ones on? What might be the effects of this behavior on the environment?

4. How many bulbs or fluorescent lamps were there in our area? Write by counting.
5. How many on-off switches were there in our area of responsibility? Write by counting.

#### What we will do?

1. Observe the lights in the place you are responsible for for five days. If there is someone in the room, put a "+" sign in the **ROOM column** in the table. If there is no one in the room, put a "-" sign in the **ROOM column**. If the lights are on in the room, put a "+" sign in the **LIGHTS column**. If the lights are on in the room, put a "-" sign in the **LIGHTS column**. If you think the lights are left on unnecessarily, turn them off and warn your friends.

	D.	AY 1	D	AY 2	D.	AY 3	D	AY 4	DA	Y 5
TIME	ROOM	LIGHTS	ROOM	LIGHTS	ROOM	LIGHTS	ROOM	LIGHTS	ROOM	LIGHTS
9:00										
10:00										
11:00										
12:00										
13:00										
14:00										
15:00										

2. What are your suggestions to reduce unnecessary light use in our school?

#### Activity 2-Taps Repair

*Purpose of the activity:* The purpose of this activity is for students to realize the importance of water as a natural resource, to gain positive attitudes and behavior towards the environment by saving water with the skill of repairing taps, and to realize the importance of efficient use of resources.

**Description**: A dripping tap causes 30-200 liters of water to be wasted per day. Repairing a dripping faucet is one of the environmentally friendly actions. For this reason, it is important for students to check whether there is a dripping faucet in their schools and homes and to gain awareness about this issue. Even if there is no dripping tap in the building they live in, students should perform this activity on existing solid taps in order to be prepared for such a situation in the future.

*Additional Information:* Some taps are called on-off faucets. If an on-off tap is to be used, this structure inside must be completely replaced.

#### Activity steps:

1. Close the plumbing valve where you live and cut off the water flow completely.

2. To prevent parts of the tap from being lost, cover the drain holes with waste paper or a paper towel.

3.Remove the cover on the tap head with a flat screwdriver.

4. After removing the tap head cover, remove the resulting screw with a screwdriver and set it aside. Remove the tap head.

5. Remove the resulting tap core by turning it counterclockwise using pliers.

6. Remove the tap gasket, which is fixed with a pin under the tap core, by pushing it with a screwdriver or by grasping the edge of the gasket with pliers.

7.Replace the tap gasket you removed with a new one.

8.Now do the exact opposite of the steps you did for disassembly. Replace the tap hub onto the tap body by turning it clockwise with pliers.

9.Place the tap head on the tap hub and place it by applying downward force.

10. Secure the tap head by tightening the faucet hub screw with a screwdriver.



11.Replace the tap head cover.

12.Open the installation valve and check the operating status of the tap and whether the dripping has stopped.

3.Do you think the amount of water in the world can change or run out?

4.Do you think you use water efficiently? What do you do to use water efficiently? What can you do to increase this efficiency?

5.What did you change for the environment by fixing a dripping faucet? What benefits did you bring to the school or your family's economy by repairing this tap?





Basic Concepts in Environmental Science and Environmental Education from a Current Perspective



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# CHAPTER 2

# Environmental Education in the Historical Process - International Collaborations to Prevent Environmental Problems

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#### Main Mechanism for Environmental Problems

Earth's life system has four major components: Atmosphere, hydrosphere, the geosphere, and the biosphere. The biosphere and the ecosystems include biotic and abiotic components i.e., living things, plants and animals, soil, water, atmosphere, heat. On the other hand, main components of an ecosystem are energy, chemicals, and organisms. Nutrient cycling and energy flow are key for a sustainable ecosystem. Figure 1 indicates the main components and relations between components of a sustainable ecosystem (Miller & Spoolman, 2018).

#### Figure 1.

Main Components of an Ecosystem (Miller & Spoolman, 2018)



Most scientific evidence indicates that people are living unsustainably. This is also known as environmental degradation. Figure 2 schematizes environmental degradation or also called as natural capital degradation. Major causes of environmental degradation include population increase, inefficient and unsustainable resource usage, poverty, absence of the detrimental environmental and health costs of goods and services in market prices, increasing isolation from nature, and competing environmental worldviews (Miller & Spoolman, 2018).

#### Figure 2.

*Environmental Degradation or Natural Capital Degradation (Miller & Spoolman, 2018)* 



Human activities often damage on environment irreversibly. Scientific discovery and technological development promised to decrease disease, hunger, and poverty. However, such advances were not cost-free due to finite resources (Union of Concerned Scientists, 1992; Howard Louis, 1998). Throughout history, humans have encountered unfavourable environmental circumstances; environmental problems became more common for this century especially after the 1960s. The source of environmental problems can be explained as industrial revolution, technology development and urbanisation. Air and water pollution from factories and other dependent problems such as erosion, pesticide contamination, deforestation, declining animals' and species' populations (Rees, 1995; Erten, 2012; Dunlap & Jorgenson, 2012; Harper & Snowden, 2017). The demands of human beings are changing. The changes in human demand on the global ecosystem can be illustrated as Figure 3 and Figure 4 (Dunlap 2007).



Figure 3. Competing Functions of The Environment (Dunlap, 2007)

#### Figure 4.

Competing Functions of The Environment- Current Station (Dunlap, 2007)



Areas of largest circle symbolize global carrying capacity in Figure 3 and areas of largest circle indicate human load in excess of global carrying capacity in Figure 4 (Dunlap, 2007). Figure 5 indicates the relationship between ecosphere, resources, waste, and human sphere (Wackernagel et. al., 1997: 3)

#### Figure 5.

The Ecological Footprint Measures Our Dependence n Nature (Wackernagel et. al., 1997: 3)



At this point there are two important concepts: Ecological footprint (EF) and biologic capacity. The concepts are also related sustainability and sustainable development (SD) which was defined as "is development that meets the needs of the present without compromising the ability of future generations to meet their own need" (WCED, 1987, p.43). Sustainability can be measured by ecological footprint which is a criterion first calculated by Wackernagel and Rees (1996). The notion denotes the amount of biologically productive land and water area necessary to generate all the resources used by an individual, society, or activity, as well as absorb the wastes produced (particularly carbon dioxide) by present technology and resource use practices (Rudolph & Figge, 2017).

By comparing resource consumption and waste creation to the capacity of the earth to regenerate, EF measures how well use natural sources are used. Six main categories

were defined related to EF: Fossil energy land, arable land, pasture, forest, built-up areas, and the sea. Fossil fuels release  $CO_2$  and toxic chemicals. Fossil energy land is related  $CO_2$  emission, fossil fuel consumption and emissions from chemical processes. Arable land is related productive land. Pasture is related grazing land and cattle farming. Forest is related farmed or natural forest which is the source of timber products. Built-up areas refer to human settlements and roads. The sea is related fish and sea products (Wackernagel et. al., 1997; Wackernagel, Lewan, & Hannson, 1999). The Earth has a biological capacity. Figure 6 indicates the biologically productive areas (Wackernagel et. al., 1997: 5)

#### Figure 6.





EF is related to consumption, productive area, and population. Figure 6 explains that Earth has a surface area approximately 51 billion hectares (36.3 billion are sea and 14.7 billion are land). Only 8.3 billion hectares of the land area are biologically productive. Biologically productive areas are limited. However, fossil fuel consumption for industry and daily life, population and demands are increasing day by day. This is the basic mechanism for starting point of environmental problems (Wackernagel et. al., 1997).

Ecosystem can restore at a certain rate. The problem is that people use and consume renewable sources of the ecosystem in an unconscious way. Now a new term should be explained: Biocapacity. Biocapacity and EF generally are presented together. Biocapacity measures the bio productive supply that is available within a certain area such as fossil energy land, arable land, built-up areas. If EF is larger than biocapacity then this results in a deficit. This is the disruption of the ecological balance. Environmental problems lead to disruption of food chain and energy pyramid. They are all related with each other (European Communities, 2006). Some statistics will be shared in terms of concretizing the content. Figure 7 indicates World trends for ecological footprint and biocapacity (Global Footprint Network (GFN), 2023a).



#### Figure 7.





Global hectare is the unit for the EF and biocapacity. In Figure 7 red area under the line indicates ecological deficit and green area indicates ecological reserve. According to graph it can be interpreted that ecological deficit increases year by year (note: last three years are estimates) (GFN, 2023b). Figure 8 indicates ecological deficit and ecologic reserve lands.

#### Figure 8.

Ecological Deficit/ Reserve Lands (GFN, 2023b)



National yields, world yields, and yield factors for all countries by land type and equivalence factors are calculation factors (GFN, 2023b). According to Figure 7 some countries' biocapacity exceeds their ecological footprint i.e., Congo (635%) Bahamas (447%), Gabon (811%). Some countries have negative notes. Table 1 indicates trends for Group of Seven (G7) countries and for more detailed information Figure 9 may be examined.

#### Table 1.

Countries with Biocapacity Deficit	Percentage that ecological footprint exceeds biocapacity
Canada	84%
Japan	-570%
Italy	-350%
United Kingdom	-240%
Germany	-190%
United States	-110%
France	-80%

Trends for G7 countries (GFN, 2023b)

#### Figure 9.

More detailed information about G7 countries (GFN, 2023b)



For Table 1 and Figure 9; 2019's data were compared since there is a note for 2020, 2021 and 2022 data: Estimate. To compare graphs World's biocapacity and EF per person data also interpreted. As one will notice that Canada is different from other G7 countries:
Biocapacity for person was 14.5 gha, ecological footprint for person was 7.9 gha. World's average ecological footprint 1.9 gha and ecological footprint for person was 2.6 gha in 1999. G7 countries are generally far from the ecological footprint concept. Until this part of the chapter, the causes of environmental problems have been tried to be explained. Finally, role of environmental education and its historical process can be explained.

#### The Origins of Environmental Education: International Collaborations

According to Tbilisi Declaration, which was a milestone for environmental education, 1977 the environmental education is "a learning process that increases people's knowledge and awareness about the environment and its associated challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action" (Educational, Scientific and Cultural Organization (UNESCO, 1977). Environmental education is a tool to raise the environmental consciousness, increase environmental literacy, and solve the environmental problems. The key for the environmental education is environmental consciousness. The environmental consciousness can be explained relationship between environmental knowledge, attitudes toward the environment and environmentally beneficial behaviours in Figure 10 (De Haan, 1996; Erten 2004; Erten 2012).

#### Figure 10.

Environmental Consciousness and Subfactors Relationship



As mentioned previously source of environmental problems is human beings' activities. Especially 1960s and 1970s were important to be examined for industrialization and fossil fuels using. 22 April 1970 was an important day since the day marks the anniversary of environmental movement (Network, 2006). After this date some international collaborations were organized to draw attention to environmental problems.

At the international level, the United Nations (UN) is the first organization to protect

environment in a broad framework. The UN held the first meeting called The United Nations Conference on the Human Environment in Stockholm and the starting date of this conference, 5 June 1972, is celebrated in all countries with various activities every year as World Environment Day (14<sup>th</sup> plenary meeting | 13 June 1972). The conference is also known as Stockholm Declaration. 113 states were invited to conference:

"Afghanistan, Algeria, Argentina, Australia, Austria, Bahrein, Bangladesh, Belgium, Bolivia, Botswana, Brazil, Burundi, Cameroon, Canada, Central African Republic, Ceylon, Chad, Chile, China, Colombia, Congo, Costa Rica, Cyprus, Dahomey, Denmark, Dominican Republic, Ecuador, Egypt, EI Salvador, Ethiopia, Federal Republic of Germany, Fiji, Finland, France, Gabon, Ghana, Greece, Guatemala, Guinea, Guyana, Haiti, Holy See, Honduras, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Ivory Coast, Jamaica, Japan, Jordan, Kenya, Kuwait, Lebanon, Lesotho, Liberia, Libyan Arab Republic, Liechtenstein, Luxembourg, Madagascar, Malawi, Malaysia, Malta, Mauritania, Mauritius, Mexico, Monaco, Morocco, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Pakistan, Panama, Peru, Philippines, Portugal, Republic of Korea, Republic of Viet-Nam, Romania, San Marino, Senegal, Singapore, South Africa, Spain, Sudan, Swaziland, Sweden, Switzerland, Syrian Arab Republic, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkiye, Uganda, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United Republic of Tanzania, United States of America, Uruguay, Venezuela, Yemen, Yugoslavia, Zaire and Zambia" (United Nations, 1972, p. 43).

Six studies of subject areas were discussed during the conference:

- Planning and management of human settlements for environmental quality (subject area I)
- Environmental aspects of natural resources management (subject area II)
- Identification and control of pollutants of broad international significance (subject area III)
- Educational, informational, social, and cultural aspects of environmental issues (subject area IV)
- Development and environment (subject area V)
- International organizational implications of action proposals (subject area VI)

Three committees discussed the report. The conference resulted in important outcomes. Declaration of the United Nations Conference on the Human Environment which included 26 principles (16 June 1972) and Action Plan for the Human Environment with

### Current Studies in Environmental Education

109 recommendations. Subject areas and related recommendations were following as:

- "Planning and Management of Human Settlement or Environmental Quality: R1-R18
- Environmental Aspects of Natural Resources Management: R19-R69
- Identification and Control of Pollutants of Broad International Significance
  - Pollution Generally: R70-R85
  - Marine Pollution: R86-R94
- Educational, Informational, Social and Cultural Aspects of Environmental Issues: R95-R101
- Development and Environment: R102-R109" (United Nations, 1972, p. 6- p. 27)

Educational, informational, social, and cultural aspects of environmental issues included between Recommendation 95 and Recommendation 101. Recommendation 96 was related establishment of an international educational programme, interdisciplinary in approach both in and out school. The establishment of The United Nations Environment Programme (UNEP) was the one of the major results of the Stockholm conference. Information programme should be designed to create environmentally conscious people. This programme also should include: Making a list of the existing educational systems, which should incorporate environmental education; sharing knowledge about these systems, particularly the distribution of the findings of teaching experiments; professional workers are trained and retrained in a variety of fields at various levels, including teacher training; to facilitate the exchange of experience between nations with comparable environmental disciplines and activities, the creation and evaluation of novel materials and approaches at all levels and types of environmental education (United Nations, 1972).

The Stockholm Declaration identified an educational need. As mentioned in Recommendation 96 addressed environmental education in 1972. International Workshop on Environmental Education was also known as The Belgrade Charter: A Framework for Environmental Education was held on 13-22 October 1975. The charter outlines the main structure and characteristics of environmental education. The basic principles of this new environmental education programmes must depend on the outcomes of United Nations Declaration on the New International Economic Order. The Belgrade Charter explained eight principles to guide environmental education programmes: Environment should be considered totally-natural and man-made, ecological, political, economic etc., a continuous life-long process, interdisciplinary in its approach, emphasize active

participation in both preventing and solving environmental problems, examine major environmental issues from a world point of view and pay attention to regional differences, focus on both current and future environmental situations, examine development and growth from an environmental perspective and promote the value of cooperation to solve environmental problems (UNESCO-UNEP, 1975). In this context,

"The goal of environmental action is to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems" (UNESCO-UNEP, 1975, p.3).

In Tbilisi (USSR) between 14 and 26 October 1977 Intergovernmental Conference on Environmental Education was organized by UNESCO in partnership with UNEP. The Tbilisi Conference was the first intergovernmental conference on environmental education. The final report of conference includes five annexes: "Annex I: Agenda, Annex II: Opening speeches, Annex III: Closing speeches, Annex IV: List of documents and Annex V: List of participants" (UNESCO, 1977, p.55-p.101). The conference focused on major environmental problems, role of education to solve environmental problems, current efforts, strategies, and cooperation for development of educational environment. 265 delegates and 65 representatives and observers participated in the conference (UNESCO, 1977). The Tbilisi Declaration stated that:

Environmental education, properly understood, should constitute a comprehensive lifelong education, one responsive to changes in a rapidly changing world. It should prepare the individual for life through an understanding of the major problems of the contemporary world, and the provision of skills and attributes needed to play a productive role towards improving life and protecting the environment with due regard given to ethical values. By adopting a holistic approach, rooted in a broad interdisciplinary base, it recreates an overall perspective which acknowledges the fact that natural environment and man-made environment are profoundly interdependent. It helps reveal the enduring continuity which links the acts of today to the consequences for tomorrow. It demonstrates the interdependencies among national communities and the need for solidarity of all mankind (UNESCO, 1977, p.24).

The World Commission on Environment and Development (WCED) first met in October 1984. Our Common Future report also known as the Brundtland Report (the Commission's chairwoman was Norwegian Prime Minister Gro Harlem Brundtland) was published in April 1987. The report included three parts and two annexes: Part I. Common Concerns, Part II. Common Challenges, Part III. Common Endeavours,



Annexe 1. Summary of Proposed Legal Principles for Environmental Protection and Sustainable Development Adopted by the WCED Experts Group on Environmental Law" and Annexe 2. (WCED, 1987). The Commission and its Work. The Commission of Environment and Development selected eight key issues: Perspectives on population, Environment and Sustainable Development; Energy; Industry; Food Security, Agriculture and Forestry; Human Settlements; International Economic Relations: Environment and International Cooperation" (WCED, 1987, p.296).

The report was influenced by "World Conservation Strategy-Living Resource Conservation for Sustainable Development". It was the first international document on living resource conservation produced with inputs from governments, non-governmental organizations, and other experts. International Union for Conservation of Nature and Natural Resources (IUCN-was founded in 1948), United Nations Environment Programme (UNEP-as mentioned, was founded in 1972) and World Wildlife Fund (WWF-was founded in 1961) prepared the World Conservation Strategy in collaboration with the "Food and Agriculture Organization of the United Nations (FAO)" and "the United Nations Educational, Scientific and Cultural Organization (UNESCO)" in 1980 (IUCN-UNEP-WWF, 1980; WCED, 1987). Figure 11 explains the symbol of World Conservation Strategy.

#### Figure 11.

The Symbol of World Conservation Strategy (IUCN-UNEP-WWF, 1980)



The symbol summarized the World Conservation Strategy report. According to symbol, "the circle symbolizes the biosphere and the three interlocking, overlapping arrows symbolize the three aims of conservation: Maintenance of essential ecological processes and life-support systems, preservation of genetic diversity and sustainable utilization of species and ecosystems" (IUCN-UNEP-WWF, 1980, p.2). World conservation strategy is needed since current essential resources are being destroyed increasingly, time problem for regeneration, disproportionate consumption of resources by the affluent i.e. One Swiss consumes as much as 40 Somalis. Conservation is a process. Both conservation and development are for people. Conservation's concern for maintenance and sustainability is a rational response to the nature of living resources (IUCN-UNEP-WWF, 1980). The

Commission proposed the concept of sustainable development as an ideal for the global economy and corporations. Sustainable development:

"is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs" (WCED, 1987, p. 37).

The United Nations Conference on Environment and Development (UNCED) was held on Rio de Janeiro, Brazil, from 3-14 June 1992. The conference was also known as Earth Summit. The report of the United Nations Conference on Environment and Development included three volumes: Volume I: Resolutions Adopted by the Conference; Volume II: Proceedings of the Conference; Volume III: Statements Made by Heads of the State or Government at the Summit Segment of the Conference. Report of the conference included 27 principles (United Nations, 1993). The Rio de Janeiro conference highlighted (Principle 1) "Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature."; Principle 3 stated that "The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations." (United Nations, 1993, p.3). Principle 8 stated that "To achieve sustainable development and a higher quality of life for all people, states should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies." (United Nations, 1993, p.4). Principle 23 stated that "The environment and natural resources of people under oppression, domination and occupation shall be protected" (United Nations, 1993, p.7). One of the important results of the UNCED Conference was Agenda 21.

Agenda 21 was a dynamic programme and focused on the pressing problems of today. Aim of it was to prepare the world for 21<sup>st</sup> century. It was a global consensus for development and environment cooperation. Strategies, plans, policies, and processes are important to achieve the aim. Agenda 21 was grouped into 4 sections: "Section I: Social and Economic Dimensions; Section II: Conservation and Management of Resources for Development; Section III: Strengthening the Role of Major Groups and Section IV: Means of Implementation" (United Nations, 1993, p.14- p.479).

Section I included international cooperation to accelerate sustainable development, poverty, changing consumption patterns, demographic dynamics and sustainability, human health conditions, sustainable human settlement development and integrating environment and development in decision-making. Section II more focused on environment i.e., protection of atmosphere, combating deforestation, managing fragile

ecosystem, conservation of biological diversity, protection of the oceans, all kind of seas, freshwater resources. Major groups are defined women, children and youth, indigenous people, local authorities, workers, business, industry, scientific and technological community in Section III. Section IV. Means of Implementation part explained financial resources and mechanisms, science for sustainable development promoting education, public awareness and training, international institutional arrangements, and legal instruments etc. (United Nations, 1993).

Chapter 36 in Agenda 21 report is important for this book chapter. Program areas described in Chapter 36: Promoting Education, Public Awareness and Training chapter are: Reorienting education towards sustainable development; Increasing public awareness and Promoting training (United Nations, 1993). Report explained the role of education. Education was expressed critical for SD:

"Education, including formal education, public awareness and training should be recognized as a process by which human beings and societies can reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues. While basic education provides the underpinning for any environmental and development education, the latter needs to be incorporated as an essential part of learning. Both formal and non-formal education are indispensable to changing people's attitudes so that they have the capacity to assess and address their sustainable development concerns. It is also critical for achieving environmental and ethical awareness, values and attitudes, skills, and behaviour consistent with sustainable development and for effective public participation in decisionmaking. To be effective, environment and development education should deal with the dynamics of both the physical/biological and socio-economic environment and human (which may include spiritual) development, should be integrated in all disciplines, and should employ formal and non-formal methods and effective means of communication" (United Nations, 1993, p.439).

In the report activities four objectives were proposed in Chapter 36 Programme Areas "A. Reorienting education towards sustainable development part"; (a) all countries are encouraged to endorse the recommendations of the Jomtien Conference. The conference was known as World Declaration on Education for All and Framework for Action to Meet Basic Learning Needs. It was held in Jomtien, Thailand, from 5-9 March 1990 The concept of Education for All is generally associated with The Jomtien Conference which is a guide to design and carry out policies and strategies for governments, international organizations, educator, and development professionals. Some 1500 participants met in the conference including policy makers, specialists in education and other major sectors,

officials, specialists (UNESCO, 1990).

The Jomtien conference emphasized "education is a fundamental right for all people, women and men, of all ages, throughout our world" (UNESCO, 1990, p.2); education is important for a safer, healthier, more prosperous and environmentally sound world, and cultural progress, tolerance, and international cooperation, Education is a key for personal and social improvement, the value of traditional knowledge and indigenous cultural heritage, basic education is fundamental to strength higher levels of education, scientific and technological literacy and capacity, (b) to achieve environmental and development awareness as soon as possible, (c) to endeavour for the accessibility of environmental and development education to social education; for all groups of people from primary school to adulthood, (d) to promote integration of environment and development concepts with especially the causes of major environment and development issues and to give special emphasis to further training of decision makers (UNESCO, 1990). 36.5 part of Agenda 21 included 15 activities (a, b, c, ...m, n, o). For more detailed information the related part of the report should be reviewed. Examples of activities will be shared in this chapter (United Nations, 1993):

(b) Governments should strive to update or prepare strategies aimed at integrating environment and development as a cross cutting issue into education at all levels within the next three years ...

(c) Countries are encouraged to set up national advisory environmental education coordinating bodies or round tables representative of various environmental, developmental, educational, gender and other interests, including non-governmental organizations, to encourage partnerships, help mobilize resources, and provide a source of information and focal point for international ties.

(e) Relevant authorities should ensure that every school is assisted in designing environmental activity work plans, with the participation of students and staff...

(f) Educational authorities should promote proven educational methods and the development of innovative teaching methods for educational settings... (p. 441).

The United Nations Convention on Climate Change (United Nations, 1992a) and the United Nations Convention on Biological Diversity (United Nations, 1992b) were also signed in 1992. According to report (1992a) parties acknowledged Earth's climate change and this is common concern of people, human activities increased the amount of greenhouse gases, developed countries are the source of the largest share of greenhouse gases, terrestrial and marine ecosystems play important role for marine ecosystems of sinks and greenhouse gases' reservoirs, recalled the importance of Stockholm Conference,



According to report (United Nations, 1992b) the contracting parties were conscious about intrinsic value and importance of biological diversity. The parties affirmed conservation of biological diversity is a common concern for people. States have sovereign rights over their own biological resources and are responsible for conserving their biological diversity and using their biological resources sustainably, concerned human activities reduce biological diversity. Article 13 is related Public Education and Awareness. The contracting parties shall use propagation through media and educational programs to promote and encourage the importance of and measures for biological diversity, and they shall collaborate in creating educational and public awareness programs with other state and international organizations.

After five years Earth Summit was held in New York by the United Nation General Assembly in a special session in 1997. The session was known as Rio+5. The General Assembly reaffirmed special session for implementation of Agenda 21 and in full respect of Rio Declaration. The date was 20 January 1997 and this was the fifty-first session (United Nations, 1997a). After nine months (19 September 1997) programme for the further implementation of Agenda 21 was adopted by the United Nations General Assembly in nineteenth special session. According to report "The United Nations Conference on Environment and Development" was a landmark event. The focus for the special session committed multi-year programme of work for the commission on SD, 1998-2002. Sustainable development's components are economic, social development, and environmental protection. The components are interdependent and mutually reinforce SD. Non-governmental organizations, educational institutions, scientific community, and media increased the public awareness. Universities and other academic centres must be supported and strengthened to promote cooperation (United Nations, 1997b).

In 1998 the Millennium Assembly of the United Nations decided to designate 55 session of the Generally Assembly as "The Millenium Assembly of the United Nations". The commission decided fifty-fourth session a sub item The Millennium Assembly of the United Nations under the titled United Nations reform: measures and proposals (United Nations, 1999). In 2000 the Millennium Declaration was organized in New York; this was the fifty-four session (A/54/2000). The motto was that: "We the peoples: the role of the United Nations in the twenty first century". The topics for sustaining our future

part were that: coping with climate change, confronting the water crisis, defending the soil, preserving forests, fisheries, and biodiversity, and building a new ethic of global stewardship (United Nations, 2000).

"World Summit on Sustainable Development" held in Johannesburg, South Africa, 26 August-4 September 2002. The Summit held 17 plenary meetings. Many governmental and non-governmental organizations were attended the World Summit. More than a hundred states i.e., Turkiye, Uzbekistan, Afghanistan, Chad, Chile, Colombia ...; five associate members of the regional commissions were represented; Timor-Leste and Palestine States were received an invitation as an observers; five economic and social commissions' secretariats were represented, United Nations bodies and programmes were presented i.e., United Nations Environment Programme, "United Nations Children's Fund", "United Nations Development Programme", "United Nations University"; the secretariats of conventions were presented i.e., "Convention of Biological Diversity", "United Nations Framework Convention on Climate Change", "United Nations Convention to Combat Desertification in Those Countries, Experiencing Serious Drought and/or Desertification", Particularly in Africa, "Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal"; specialized agencies and related organisations were represented i.e., "World Health Organization", "International Fund for Agricultural Development", "World Meteorological Organization", "World Tourism Organization", "World Trade Organization"; intergovernmental organisations were represented i.e., African Development Bank, Asian Development Bank, Latin American Economic System. The topics were health and environment, biodiversity and ecosystem management, agriculture, cross-sectoral issues (finance/trade, technology transfer, information/education/science, consumption patterns and capacity-building), water and sanitation and energy in Chapter III. According to report, action is needed at all levels, partnerships between governments and non-governmental organizations are needed and follow-up is needed for each WEHAB (Water, Energy, Health, Agriculture and Biodiversity) areas (United Nations, 2002). In fifty-seventh session General Assembly decided to adopt sustainable development as a key element for United Nations activities, to achieve development goals on 21 February 2003 (United Nations, 2003).

The 2005 World Summit was held on 14-16 September 2005, in New York. The General Assembly resolved to create a more peaceful, prosperous, and democratic world and focus on these problems to provide multilateral solutions: Development, peace and collective security, human rights and the rule of law and strengthening of the United Nations. Education for all programmes as a tool to achieve the millennium development goal universal primary education by 2015 and committed to promote education for peace and human development. Sustainable consumption and production patterns will be promoted and the efforts related to recycling economy will be supported for developing countries. Committee acknowledge partnerships for advance action on clean energy and climate

change, including bilateral, regional, and multilateral initiatives. Sound management of chemicals and hazardous wastes will be promoted (United Nations, 2005).

In 2005 as mentioned United Nations adopted the Millennium Declaration (United Nations, 2000). 2015 Declaration was the deadline for achievement of most of its commitments. The eight Millenium Development Goals provided a framework and in 2008, trends are assessed. These development goals were that:

"Goal 1. Eradicate extreme poverty and hunger, Goal 2. Achieve universal primary education, Goal 3. Promote gender equality and empower women, Goal 4. Reduce child mortality, Goal 5. Improve maternal health, Goal 6. Combat HIV/AIDS, malaria and other diseases, Goal 7. Ensure environmental sustainability, Goal 8. Develop a global partnership for development" (United Nations, 2008, p1).

Millennium Development Goals Summit was held on 20-22 September 2012 in New York (United Nations, 2010). United Nations Conference on Sustainable Development in Rio which was also known as Rio+20 due to twenty years after the Earth Summit. The motto was: The future we want. General Assembly reaffirmed Declaration of the United Nations Conference on the Human Environment adopted previous declarations, outcomes of meetings and action plans. There are important points i.e., Commission emphasized the need to make progress in implementing previous commitments. Poverty is a still important problem. Climate change is a cross-cutting and persistent crisis. Green economy policies should be promoted. Strengthening the three dimensions of sustainable development and intergovernmental arrangements for sustainable development are important. Thematic areas and cross-sectoral issues were defined Commission reaffirmed the Millenium Development Goals are useful however the goals should address and incorporate all three dimensions of sustainable development (United Nations, 2012). In 2013 the Millenium Development Goals Report was published and this special event defined as it will add momentum for 2015 and the challenges of sustainable development (United Nations, 2013).

United Nations on Sustainable Development summit was held on 25-27 September 2015 in New York. The motto was: Transforming our world: the 2030 Agenda for Sustainable Development. This Agenda was explained as a plan of action for people, planet, and prosperity. Eradicating poverty is the greatest challenge for sustainable development. 17 Sustainable Development Goals and related 169 targets were announced and adopted "win-win" cooperation to bring huge gains four all countries and world. New goals will be a guide next 15 years' decisions. The positive contribution of migrants was recognized. Climate change and environmental degradation were addressed. Social and economic development depend on sustainable management and usage of natural resources. Commission determined to conserve and sustainable usage of water resources, biodiversity, ecosystems. Sustainable urban development is a crucial issue. Peace and security are keys for SD (United Nations, 2015a). Figure 12 indicates the 17 Sustainable Development Goals (SDG) (United Nations, 2015b).

#### Figure 12.

Sustainable Development Goals (United Nations, 2015b)



"SDG1. End poverty in all its forms everywhere, SDG2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture, SDG 3. Ensure healthy lives and promote well-being for all at all ages, SDG 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all, SDG 5. Achieve gender equality and empower all women and girls, SDG 6. Ensure availability and sustainable management of water and sanitation for all, SDG 7. Ensure access to affordable, reliable, sustainable, and modern energy for all, SDG 8. Promote sustained, inclusive, and sustainable economic growth, full and productive employment and decent work for all, SDG 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation, SDG 10. Reduce inequality within and among countries, SDG 11. Make cities and human settlements inclusive, safe, resilient, and sustainable, SDG 12. Ensure sustainable consumption and production patterns, SDG 13. Take urgent action to combat climate change and its impacts, SDG 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development, SDG 15. Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss, SDG 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable, and inclusive institutions at all levels, SDG 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development" (United Nations, 2015a, p.14).

Paris Conference on Climate Change was held in same year. It was also known as COP21. The conference was the 21<sup>st</sup> yearly session of the Conference of Parties (COP). Paris Agreement was done at Paris on 12 December 2015. It entered into force on 4 November 2016. Aim of the agreement was to strength global response for the reduction of climate change: "Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change" (United Nations, 2015c, p. 3). Koseoglu and Erten explained that how environmental education must be according to the Paris Agreement. As a result of the analysis, the results of the Paris Agreement were coded as nine codes. These codes included basic ecological concepts, environmental problems and features, global warming, climate change, food and agricultural safety, environmental education and environmentally friendly behaviours, technology in solving environmental problems, sustainable development, social justice, and climate justice (Koseoglu & Erten, 2022).

Stockholm+50 was held on 2 and 3 June 2022. The motto was that: A healthy planet for the prosperity of all- our responsibility, our opportunity. Four plenary meetings and 3 leadership dialogues were held during the process. Many speakers alluded to historical importance of Stockholm Conference which was held in 1972 and emphasized the international environmental agreements from 1972 to 2022; particularly the United Nations Framework Convention on Climate Change, the United Nations Convention to Combat Desertification and the Convention on Biological Diversity. According to report, to raise awareness and create positive public consciousness for both environment and climate action, environmental awareness should be integrated to education systems. Environmental education should be introduced from a young age (United Nations, 2022).

Curriculums are updated from time to time in line with needs. There are three basic areas of knowledge and competence regarding teaching. These are content knowledge, pedagogy knowledge and pedagogical content knowledge. In this context there are two courses related to environment and related topics: "Environmental Education" and Sustainable Development and Education. Content of Environmental Education course includes in Turkiye:

Basic ecological concepts and principles, ecosystems, food chains, food web, habitat, competition; partner life and mutual living, energy flow, circulation of matter, population growth, ecological impact, erosion, soil and water resources, environmental awareness, studies on environmental awareness in the world, institutions, and organizations; Environmental education in primary education programs (Council of Hihger Education, 2018, p. 14).

Content of Sustainable Development and Education course includes in Turkiye:

The concept of sustainability and its usage areas; sustainability in terms of social sciences and sciences; sustainability in the context of social change; education and sustainability; the future of humanity and sustainability; migration, poverty and inequality; sustainable environment; ecology, global environment issues and sustainability; sustainable society in harmony with nature; population, economic system and natural environment; technological developments, consumption habits and environment; social responsibility work sustainability in terms of tangible and intangible cultural heritage; human-nature relations Rethinking on the axis of sustainability (Council of Higher Education, 2018, p.18).

The process of updating teacher training undergraduate programs has been completed in 2018. It may be said that the course contents and the contents in the reports are parallel. The world has changed in many ways. From Stockholm Declaration to Stockholm+50 there are many international conferences and agreements. In this chapter it has been endeavoured to explain the relations between these, the historical process, and the relation between outcomes of reports and environmental education. Some of these meetings are directly related to environmental education; some are related to sustainable development.

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# **CHAPTER 3**

# Fostering Environmental Consciousness in Early Childhood

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#### Introduction

In today's rapidly changing world, there is a growing recognition of the critical role that early childhood environmental education plays in nurturing a generation of environmentally conscious individuals. The experiences and knowledge acquired during the formative years of childhood have a profound and lasting impact on a child's relationship with the natural world. As educators, parents, and caregivers, we are uniquely responsible for shaping the environmental attitudes and behaviors of the youngest members of our society.

This book chapter explores the dynamic realm of early childhood environmental education, drawing upon the latest research and insights in the field. Our journey into this vital domain is guided by the understanding that fostering environmental consciousness in early childhood is not only a means of nurturing a love for the environment but also an essential step toward building a sustainable and harmonious future.

Throughout this chapter, we delve into the cognitive development of young children and their innate capacity to form connections with the environment. We examine the manifold benefits of early exposure to nature and environmental education, spanning academic, emotional, and social dimensions. In a world increasingly characterized by digital screens and indoor activities, the need to design effective early childhood environmental education programs becomes evident. We explore the strategies, curricular approaches, and roles of educators and parents in imparting these critical lessons.

The heart of this chapter lies in its exploration of recent research on early childhood

environmental education. We dissect studies that demonstrate the profound impact of nature exposure on cognitive development, emotional well-being, and long-term environmental attitudes and behaviors. Additionally, we address the challenges and barriers faced in the implementation of such programs, emphasizing the need for inclusivity and accessibility for all children, regardless of their geographical location or socio-economic background.

Furthermore, this chapter goes beyond theory to offer practical guidance. It presents three sample nature and environmental awareness activities designed to engage young children in hands-on, experiential learning about the environment. These activities are intended to serve as illustrative examples, showcasing the principles and methods discussed throughout the chapter.

As we embark on this journey into the realm of early childhood environmental education, we hope that educators, parents, and caregivers will gain a deeper understanding of the significance of their role in nurturing the environmental stewards of tomorrow. By harnessing the power of early childhood education and incorporating the latest research findings, we can collectively sow the seeds of environmental consciousness in young minds, fostering a lifelong connection to and responsibility for the natural world. Together, we can shape a more sustainable and environmentally aware future.

## **The Cognitive Development and Environmental Awareness in Early Childhood** Cognitive development and environmental awareness are inseparable facets of a child's early development, deeply intertwined in shaping their growth and future trajectory. In the realm of cognitive development, the formative years are instrumental in establishing the fundamental building blocks of learning, encompassing memory, attention, problemsolving, and critical thinking skills. These cognitive abilities provide the cognitive framework necessary for comprehending and engaging with environmental information.

Moreover, cognitive development plays a pivotal role in language acquisition, enabling children to articulate their observations and thoughts about their surroundings. Effective language skills empower them to express and grasp environmental concepts, fostering a bridge between cognition and environmental awareness. As cognitive abilities mature, children also become more adept at processing and categorizing environmental information, recognizing patterns, and comprehending the intricate interconnections within their surroundings.

Inextricably tied to cognitive development is the development of environmental awareness. This relationship is forged through sensory perception, as cognitive development influences a child's ability to perceive and interpret environmental cues through their senses (Bjorklund and Causey, 2018b). These sensory inputs provide the foundation upon which environmental awareness is built. Furthermore, cognitive development enables children to construct cognitive schemas, effectively organizing

their experiences and knowledge concerning the environment. These mental frameworks serve as the basis for comprehending complex environmental concepts and processes.

According to Piaget (1977), cognitive development also bestows children with vital problem-solving and decision-making skills, essential for addressing environmental challenges and making informed choices regarding sustainable practices. It fosters emotional and moral growth, allowing children to develop empathy for the environment, recognize the ethical dimensions of their actions, and cultivate a sense of responsibility toward nature. Ultimately, cognitive development in early childhood exerts a lasting influence on an individual's capacity to engage with and contribute to environmental awareness and sustainability throughout their life.

In conclusion, the interplay between cognitive development and environmental awareness during early childhood is a critical nexus in fostering environmentally conscious individuals capable of addressing the challenges of a changing world. Educational approaches in early childhood should underscore this interrelationship, nurturing cognitive development alongside environmental education to promote the holistic growth and sustainable stewardship of the environment.

#### **Cognitive Development in Early Childhood**

Cognitive development in early childhood lays the foundation for a child's ability to understand and engage with the world around them. This period, typically spanning from birth to age six, is marked by rapid cognitive growth and a series of developmental milestones. Understanding the stages of cognitive development is essential for designing effective early childhood environmental education programs.

#### Foundational Principles of Cognitive Development

Cognitive development is a dynamic process that encompasses various aspects of thinking, problem-solving, and understanding. Psychologist Jean Piaget's stages of cognitive development provide valuable insights into this progression (Berger, 2008):

- 1. Sensorimotor Stage (Birth to 2 years): During this stage, infants and toddlers explore the world primarily through their senses and motor activities. They learn about cause and effect and develop object permanence, understanding that objects continue to exist even when not in sight.
- 2. Preoperational Stage (2 to 7 years): In this stage, children start to use language and symbols to represent objects and ideas. However, they often exhibit egocentrism, where they struggle to see things from others' perspectives.
- **3.** Concrete Operational Stage (7 to 11 years): Children in this stage become more logical in their thinking and can perform concrete operations, such as conservation (understanding that the quantity of a substance remains the same despite changes in appearance).

4. Formal Operational Stage (11 years and older): At this stage, adolescents and adults develop the ability to think abstractly and engage in hypothetical and deductive reasoning.

#### Cognitive Abilities in Early Childhood and Environment

During the early years of childhood, cognitive abilities are rapidly evolving. Children in this age group are particularly adept at absorbing information from their environment. Their cognitive abilities include:

- **Memory Development:** Young children have a remarkable capacity for memorization, enabling them to learn and retain information about the natural world.
- Language Development: Language acquisition is a pivotal aspect of cognitive development. It allows children to communicate their observations, questions, and thoughts about the environment.
- **Imaginative Play:** Pretend play and imagination contribute to cognitive development by allowing children to experiment with different roles and scenarios, including those related to nature and the environment.

Cognitive development and nature/environmental education share a deeply intertwined relationship, one that holds profound implications for a child's holistic growth. Nature, with its diverse and multisensory stimuli, serves as a potent catalyst for cognitive development during early childhood. Exposure to natural environments nurtures a child's innate curiosity, sparking questions, observations, and inquiries (Chawla, 1999). This engagement fosters cognitive skills such as critical thinking, problem-solving, and creativity. As children explore the natural world, they encounter puzzles to solve, patterns to discern, and relationships to understand, all of which contribute to the development of their cognitive faculties.

Furthermore, nature/environmental education leverages the child's inherent fascination with the environment to enhance their cognitive abilities (Müller et al., 2017). It provides a context-rich platform for learning, where complex concepts like ecosystems, biodiversity, and sustainability come to life through direct experiences. As children engage in hands-on activities such as planting, observing wildlife, or participating in conservation efforts, they not only absorb factual knowledge but also cultivate cognitive skills like categorization, analysis, and synthesis. They learn to ask questions, seek answers, and apply critical thinking to real-world environmental challenges.

Moreover, nature/environmental education amplifies the cognitive benefits of nature exposure by incorporating structured learning opportunities (Chawla, 2015). It encourages children to think critically about environmental issues, stimulating their intellectual growth. They explore cause-and-effect relationships, consider the long-term

consequences of human actions on the environment, and develop the capacity to make informed decisions based on a deeper understanding of ecological systems. In essence, nature/environmental education complements and enhances cognitive development by fostering a profound and lasting connection between a child's cognitive faculties and the natural world.

In conclusion, cognitive development and nature/environmental education share a symbiotic relationship, with nature serving as a dynamic canvas for cognitive growth, and environmental education offering a structured framework to channel that growth towards ecological understanding and responsible stewardship. This synergy not only enriches a child's cognitive development but also equips them with the knowledge and skills necessary to navigate the complex environmental challenges of our world.

#### The Emergence of Environmental Awareness

As children progress through their early years, they begin to form connections with the environment and develop an awareness of the natural world (Alliance, 2017). This awareness is a crucial step towards fostering environmental consciousness. Here are some key aspects to consider:

#### Early Signs of Environmental Awareness



Children often exhibit an innate curiosity about animals, plants, and natural phenomena (Prins et al., 2022). They may ask questions about the world around them, such as "Why do birds sing?" or "Where do clouds come from?" This curiosity is a natural part of their developmental process, as they seek to understand and make sense of the environment, they live in. It's a sign of their growing awareness and the beginning of their exploration of the natural world.



Many children develop attachments to animals, both real and fictional. These attachments

can take various forms, from having favorite animals they adore to expressing empathy and care towards animals. These connections with the animal kingdom can be powerful, often shaping their interests and fostering a sense of responsibility and compassion. It's not uncommon for children to develop a deep affection for pets or to form strong emotional bonds with characters from stories featuring animals.

#### Figure 1.

Example Early Signs of Environmental Awareness



Attachment to Animals: Many children develop attachments to animals, both real and fictional. They may have favorite animals



Interest in Seasons and Weather: Young children often show interest in seasonal changes, weather patterns, and the outdoor environment. They may eagerly anticipate snowfall, rain, or the arrival of spring.

Young children often display a keen interest in seasonal changes, weather patterns, and the outdoor environment. They eagerly anticipate and observe the arrival of different seasons, from the excitement of snowfall in winter to the joy of spring blossoms. Their fascination with weather can lead to a desire to understand the science behind it, such as what causes rain or how seasons change. This interest in the natural world can be nurtured and harnessed as a valuable educational tool, helping children develop a deeper understanding of their surroundings.

#### **Developing a Sense of Place and Attachment to Nature**

Children develop a sense of place as they become familiar with their local environment. This sense of place forms the basis for their connection to and sense of responsibility for their surroundings. Additionally, building emotional connections to nature is vital (Otto et al., 2019). Children who feel emotionally attached to the natural world are more likely to care for and protect it as they grow.

#### Age-Appropriate Ways to Introduce Environmental Concepts

Tailoring educational experiences to a child's developmental stage is crucial. For instance, preschoolers may benefit from simple, hands-on activities that involve observing and exploring the natural world, while older children can engage in more complex discussions about environmental issues. In nurturing environmental awareness, it's essential to recognize that children's connection to the environment is a gradual process (Brussoni et. al, 2017). By acknowledging and supporting their innate curiosity

and attachment to nature, we can pave the way for deeper environmental understanding and a lifelong commitment to sustainability.

Early exposure to environmental concepts is integral to shaping a child's environmental consciousness and fostering a commitment to sustainable practices (Chawla, 2015). Environmental education at a young age lays the foundation for responsible environmental stewardship in the future (Chaney, 2021). However, it is crucial that educators and parents adopt age-appropriate methods and strategies to effectively communicate these concepts to children. This paper seeks to elucidate the significance of tailoring environmental education to different developmental stages and presents practical approaches for introducing environmental concepts to children.

*Early Childhood (Ages 3-6):* The early childhood years are characterized by a profound curiosity about the world. To introduce environmental concepts effectively at this stage, educators and parents should focus on sensory experiences and hands-on activities. Nature walks, simple gardening, and storytelling sessions that highlight the beauty and wonder of the natural world can captivate young minds. Incorporating basic concepts like the importance of clean water and air, the role of plants and animals, and the idea of conservation through age-appropriate language and activities can set a strong foundation for environmental awareness.

*Middle Childhood (Ages 7-11):* As children progress into middle childhood, their cognitive abilities expand. At this stage, educators can delve deeper into environmental concepts by introducing more complex topics such as ecosystems, biodiversity, and environmental challenges (Louv, 2005). Hands-on experiments, field trips, and interactive projects can engage children in understanding ecological interdependencies. Discussions about climate change, pollution, and waste management can be framed in a way that encourages critical thinking and problem-solving. Encouraging children to take small actions, like reducing waste or participating in community clean-up events, can empower them to make a tangible difference.

Adolescence (Ages 12-18): During adolescence, teenagers develop a deeper capacity for abstract thinking and critical analysis. Environmental education at this stage can include an in-depth exploration of environmental issues, ethical considerations, and the global impact of human actions. Students can engage in debates, research projects, and advocacy efforts related to environmental conservation. Encouraging them to explore topics of personal interest within the environmental field, such as renewable energy, conservation biology, or sustainable agriculture, can ignite a passion for environmental science and advocacy.

Age-appropriate introduction of environmental concepts is pivotal in nurturing a generation that is environmentally conscious and capable of addressing the complex

ecological challenges of the future. By recognizing the developmental stages of children and tailoring educational approaches accordingly, educators and parents can maximize the effectiveness of environmental education. The strategies outlined in this chapter, from sensory experiences in early childhood to critical analysis in adolescence, provide a roadmap for cultivating a sense of environmental stewardship from a young age. In doing so, we can empower children to become informed, responsible, and proactive custodians of our planet.

#### **Role of Curiosity and Exploration**

Curiosity is a driving force in children's learning and plays a pivotal role in their environmental awareness and education. Understanding how to harness and encourage this curiosity is essential for effective early childhood environmental education.

#### How Curiosity Drives Learning in Young Children

- Curiosity is a natural inclination that compels children to explore and seek answers to their questions. It motivates them to investigate the world around them.
- Inquisitiveness promotes active engagement with the environment. Children are more likely to retain information when they are genuinely interested.

#### **Encouraging Curiosity About the Natural World**

- Create opportunities for exploration and discovery in natural settings. Outdoor environments, parks, gardens, and nature trails offer rich learning experiences.
- Encourage open-ended questions and inquiry-based learning. Instead of providing immediate answers, guide children in exploring and finding answers themselves.

#### **Benefits of Open-Ended Exploration and Inquiry**

- Open-ended exploration allows children to develop problem-solving skills and critical thinking abilities as they encounter challenges and seek solutions in the natural world.
- It fosters creativity and imaginative thinking. Nature's complexity provides ample opportunities for children to use their imagination and invent stories, games, and scenarios.

#### Fostering a Sense of Wonder and Awe in Nature

- Cultivating a sense of wonder and awe in children is a powerful way to deepen their connection to the environment. Encourage moments of quiet observation and reflection in nature (NLI, 2019).
- An educator can share a sense of wonder and enthusiasm about the natural
- world. When adults model a fascination with nature, children are more likely to adopt similar attitudes.

In summary, curiosity and exploration are fundamental drivers of early childhood environmental education. By understanding the role these qualities play in cognitive development and environmental awareness, we can design educational experiences that tap into children's innate curiosity, encourage exploration, and ultimately cultivate a deep appreciation for the natural world. In the subsequent sections of this chapter, we will explore the benefits of early childhood environmental education and guide designing effective programs to harness the potential of young minds in building a sustainable future.

#### **Benefits of Early Childhood Environmental Education**

Early childhood environmental education, when thoughtfully designed and implemented, offers a multitude of profound and far-reaching benefits. These advantages extend beyond the immediate developmental gains, leaving a lasting impact on children's cognitive, emotional, and social well-being. In this section, we delve into the various dimensions of these benefits, emphasizing the significance of nurturing young environmental stewards.

#### Academic Advantages

Early exposure to environmental education provides a strong foundation for academic achievement. Research has demonstrated that such programs enhance cognitive skills, promote problem-solving abilities, and foster a deeper understanding of scientific concepts (Meyer et al., 2017; Shutte et al., 2017; Williams and Dixon, 2013)). Key academic advantages include:

#### Figure 2.

Academic Advantages of EE



Engaging with the natural world encourages critical thinking and observation skills (Wells, 2000). Children learn to make connections between their experiences in nature and abstract academic concepts, thereby improving their cognitive abilities. Secondly, early exposure to environmental science concepts helps children develop science literacy, including an understanding of ecosystems, biodiversity, and environmental processes (Cutter-Mackenzie & Edwards, 2013). This foundation can lead to improved

performance in science-related subjects throughout their educational journey.

Moreover, many environmental activities involve quantifying and measuring natural phenomena. This provides children with opportunities to develop math skills through practical applications, reinforcing numerical concepts (Wilson, 1996). Additionally, Environmental education encourages communication and vocabulary development as children describe their observations and engage in discussions about the natural world. These interactions enhance language acquisition and communication skills.

#### **Emotional and Social Development**

Beyond academic advantages, early childhood environmental education contributes significantly to emotional and social development. It fosters empathy, emotional resilience, and positive social interactions, laying the groundwork for healthy emotional intelligence (Chaney, 2021, Dankiw et al., 2020). Key emotional and social benefits include:

- Empathy and Compassion: Caring for and learning about the environment instills a sense of responsibility and empathy for living beings. Children develop a deeper connection to nature and a greater appreciation for the wellbeing of others.
- **Emotional Resilience:** Exposure to the natural world can reduce stress and anxiety in children. Spending time outdoors promotes emotional resilience, helping children manage emotions and cope with life's challenges.
- **Teamwork and Collaboration:** Many environmental education activities are collaborative. Children learn to work together, share responsibilities, and communicate effectively with peers, enhancing their teamwork and collaboration skills.
- **Respect for Diversity:** Environmental education encourages an understanding of the interdependence of all living things and ecosystems. This fosters an appreciation for diversity, both in the natural world and among people.

Engaging with the environment fosters empathy and compassion within children, nurturing a profound sense of responsibility towards all living beings. This connection to nature cultivates a heightened appreciation for the well-being of others, promoting a more compassionate outlook on life. The natural world serves as a powerful antidote to stress and anxiety, benefiting children's emotional resilience. Time spent outdoors equips them with valuable tools to manage their emotions, helping them navigate the challenges that life presents with greater ease. EE frequently involves collaborative activities that encourage teamwork. Children partake in shared responsibilities and effective communication with their peers, honing their ability to collaborate and work as part of a team. Through EE, children gain insight into the intricate interdependence of

all living things and ecosystems. This awareness not only deepens their respect for the natural world but also fosters an appreciation for the diversity found both within nature and among people.

#### **Building a Lifelong Connection with Nature**

One of the most enduring benefits of early childhood environmental education is the cultivation of a lifelong connection to the natural world. Children who experience the wonders of nature at a young age are more likely to become environmentally conscious adults (Adams & Savahl, 2017; Stern et al., 2014; Wals & Benavot, 2017). Key aspects of building this lifelong connection include:

- Environmental Stewardship: Early exposure to environmental concepts instills a sense of responsibility for the planet. Children learn the importance of conservation and sustainable living practices, leading to environmentally conscious choices in adulthood.
- Nature as a Source of Well-being: Encounters with nature in childhood establish a positive relationship with the outdoors. As adults, individuals who have experienced the benefits of nature in their formative years are more likely to prioritize outdoor activities and seek solace in natural settings.
- Environmental Advocacy: Early childhood environmental education empowers children to become advocates for environmental causes. As they grow, they are more inclined to engage in environmental activism, making meaningful contributions to addressing environmental challenges.

In conclusion, the benefits of early childhood environmental education are multifaceted, encompassing academic, emotional, and social advantages, as well as the development of a lifelong connection to nature. These benefits underscore the importance of incorporating environmental education into early childhood curricula, nurturing the growth of environmentally conscious citizens who are equipped to address the complex environmental issues of the future.

#### **Designing Effective Early Childhood Environmental Education Programs**

The success of early childhood environmental education hinges on the thoughtful design and implementation of educational programs that cater to the unique needs and developmental stages of young learners. This section explores the essential elements and strategies for creating effective programs that nurture a love for the environment and promote sustainable behaviors among children.

#### Age-Appropriate Curriculum Development

Recognizing the developmental differences among young children is paramount in designing effective environmental education programs. Curriculum development should align with the cognitive, emotional, and physical capabilities of the target age group.

Key considerations include developmentally appropriate practices, hands-on learning, and storytelling and play.

Programs should incorporate activities and materials that are suitable for the specific age range, ensuring that children can engage meaningfully with the content. Moreover, young children learn best through hands-on experiences. Incorporating sensory-rich activities, such as the exploration of natural materials, encourages active learning (Gibson, 2014). Also, storytelling and imaginative play can be powerful tools in environmental education (Wilson, 1996). Narratives and role-play scenarios help children connect with environmental concepts on a personal level.

#### **Incorporating Nature-Based Learning**

Nature-based learning is a fundamental component of early childhood environmental education. It offers direct experiences with the natural world, fostering a deep connection to and appreciation for the environment. Key principles of nature-based learning include:

- **Outdoor Exploration:** Frequent and varied outdoor experiences provide children with opportunities to observe, interact with, and learn from the natural world. Nature trails, gardens, and outdoor classrooms are valuable resources.
- Seasonal Observations: Encouraging children to observe and document seasonal changes in their environment builds an understanding of ecological processes and the cyclical nature of life.
- Wildlife Encounters: Interactions with local wildlife, such as birds, insects, and small mammals, spark curiosity and inspire questions about the interconnectedness of life.

#### The Role of Educators and Parents

Educators and parents play pivotal roles in the success of early childhood environmental education programs. Their guidance and support are essential in cultivating a child's environmental consciousness. Key roles and responsibilities include:

- Educator Training: Teachers and caregivers should receive training in environmental education principles and pedagogy to effectively facilitate learning experiences.
- **Creating Nature-Rich Environments:** Educators and parents can shape learning environments by providing access to natural materials, books on environmental topics, and opportunities for outdoor play.
- Encouraging Inquiry: Both educators and parents should encourage children to ask questions, explore their surroundings, and share their observations. This fosters a sense of curiosity and inquiry.
- Modeling Environmental Stewardship: Adults can model environmentally

responsible behaviors, such as recycling, conserving resources, and practicing sustainable living, to reinforce the importance of such actions.

#### **Promoting Outdoor Play and Exploration**

Outdoor play is a cornerstone of early childhood environmental education. It not only supports physical development but also provides a context for children to apply their environmental knowledge. Strategies for promoting outdoor play include:

- Free Play: Allowing unstructured play in natural settings enables children to explore and discover the environment at their own pace, fostering creativity and problem-solving skills.
- **Nature Journals:** Encouraging children to keep nature journals to document their outdoor experiences promotes observation skills and reflection on their interactions with the environment.
- Nature-Based Art and Crafts: Artistic activities using natural materials, such as leaves, sticks, and stones, connect creativity with the natural world and encourage resourcefulness.

In summary, effective early childhood environmental education programs are thoughtfully designed to align with the developmental stages of young learners, incorporate naturebased learning experiences, involve educators and parents as partners, and promote outdoor play and exploration. By integrating these elements, programs can instill a lifelong love for the environment and equip children with the knowledge and values necessary to become environmentally conscious and responsible citizens.

#### **Recent Research on Early Childhood Environmental Education**

The field of early childhood environmental education has witnessed a surge in research activities in recent years, as educators, policymakers, and researchers recognize the importance of fostering environmental consciousness in young children. This section delves into some of the noteworthy studies and findings that shed light on the impact and effectiveness of early childhood environmental education programs.

#### Studies on the Impact of Nature Exposure

Numerous studies have delved into the positive impacts of children's exposure to natural environments on their physical, cognitive, and emotional development. These investigations consistently underscore the significance of integrating nature into early childhood education.

One compelling area of influence is cognitive development, where research has established that regular exposure to natural settings plays a pivotal role in enhancing cognitive growth in young children. The presence of nature-rich environments stimulates their innate curiosity, encourages keen observation, and fosters problem-solving skills. It has been observed that children who are regularly exposed to green spaces tend to exhibit better performance in tasks demanding sustained attention and focus.

In addition to cognitive benefits, the emotional well-being of children is profoundly influenced by exposure to nature. Multiple studies have documented the positive impact of nature exposure on emotional health. Time spent in natural settings has been linked to reduced levels of stress, anxiety, and symptoms associated with attention deficit disorders. Furthermore, the immersion in nature fosters a profound sense of calmness and emotional resilience, empowering children to navigate and cope with various challenges they encounter.

The advantages of integrating nature into early childhood education extend beyond the cognitive and emotional realms to encompass physical health. Research findings have consistently demonstrated that outdoor play in natural environments promotes physical activity and encourages healthier lifestyles among children (Gray et al., 2015; Meyer et al., 2017; Twohig-Bennett & Jones, 2018). Those who engage in nature-based activities are more likely to exhibit lower rates of childhood obesity and related health issues, showcasing the tangible health benefits of nature-rich educational environments.

To summarize, the body of research illuminates the multifaceted advantages of incorporating nature into early childhood education. From augmenting cognitive development and emotional well-being to nurturing physical health, these findings underscore the imperative of integrating natural environments into educational settings, facilitating holistic development and well-rounded growth in our youngest learners.

#### Assessing the Effectiveness of Outdoor Classrooms

Outdoor classrooms, where learning unfolds in natural settings, have garnered significant attention and recognition within the realm of early childhood education. Rigorous research endeavors aimed at examining the effectiveness of these environments have generated valuable insights, shedding light on the multifaceted advantages they offer.

Firstly, studies have consistently suggested that outdoor classrooms hold the potential to positively influence academic achievement among children (. The immersive nature of outdoor learning experiences often translates into enhanced performance across a spectrum of academic disciplines, including science, mathematics, and language arts. This phenomenon underscores the idea that the integration of natural environments can serve as a powerful catalyst for intellectual growth.

Moreover, outdoor classrooms serve as dynamic spaces for social and emotional development. Encounters with the natural world inherently encourage social interactions, cooperation, and collaborative problem-solving among children. Research findings indicate that these environments play a pivotal role in fostering social and emotional growth, contributing to the development of advanced communication skills and conflict-resolution abilities. Such attributes are essential for holistic child development.

Furthermore, the profound impact of outdoor classrooms extends to the cultivation of pro-environmental attitudes and behaviors among young learners. Exposure to these environments has been closely linked to the development of heightened environmental consciousness. Children who engage in learning activities within nature-rich settings tend to exhibit greater concern for the environment and an increased willingness to embrace sustainable practices. This facet highlights the potential of outdoor classrooms to nurture environmentally responsible citizens who are attuned to ecological issues.

Outdoor classrooms have emerged as a dynamic and multifunctional asset within the realm of early childhood education. They not only enhance academic performance but also facilitate holistic development by promoting social and emotional growth. Additionally, the cultivation of pro-environmental attitudes and behaviors underscores their role in shaping environmentally conscious individuals. As the educational landscape continues to evolve, outdoor classrooms stand as a testament to the potential of nature-integrated learning environments in nurturing well-rounded, environmentally aware young minds.

#### Long-Term Outcomes of Early Environmental Education

Longitudinal studies that have meticulously tracked the effects of early childhood environmental education well into adulthood have provided compelling evidence of its profound and enduring impact. These studies offer a glimpse into how early exposure to environmental concepts and values continues to shape individuals throughout their lives, with far-reaching consequences for both personal choices and societal contributions (Stern et al., 2014).

Foremost among the findings is the emergence of environmental stewardship as a defining trait among those who received early environmental education. Such individuals are more likely to exhibit environmentally responsible behaviors in adulthood. They actively engage in practices such as recycling, conserving energy, reducing waste, and supporting various environmental causes. This enduring commitment to sustainable living is a testament to the lasting imprint of early environmental education on personal values and actions.

Moreover, research highlights that early environmental education can be a catalyst for environmental advocacy. Adults who were exposed to environmental education during their formative years often translate their passion and knowledge into meaningful action. Many become active participants in community-based environmental initiatives and advocacy efforts, striving to effect positive change on a broader scale. Their engagement in these activities underscores the transformative power of early environmental education in nurturing a sense of environmental responsibility and the drive to make a difference.

Furthermore, the influence of early environmental education extends beyond individual behaviors and into career choices. Individuals who receive a strong foundation in environmental education during childhood frequently gravitate towards careers that

are intrinsically linked to environmental conservation and sustainability. These career paths encompass diverse fields, including ecology, environmental policy, conservation biology, and sustainable development. The alignment of personal values cultivated in childhood with professional pursuits reflects the profound and enduring impact of early environmental education on life trajectories.

#### Figure 3.

Long-Term Outcomes of Early Environmental Education

2	Environmental Stewardship: • Individuals who received early environmental education are more likely to adopt environmentally responsible behaviors in adulthood. They engage in activities such as recycling, conserving energy, and supporting environmental causes.
	Environmental Advocacy: • Research demonstrates that early environmental education can inspire individuals to become environmental advocates. Many adults who had exposure to environmental education during their early years actively participate in community environmental initiatives and advocacy efforts.
	Career Paths: • Early environmental education can influence career choices. Individuals with a strong foundation in environmental education often pursue careers in fields related to conservation, sustainability, ecology, and environmental policy.

In conclusion, the evidence from longitudinal studies underscores the lasting significance of early childhood environmental education. It not only shapes individuals into environmentally responsible adults but also propels them towards active advocacy and careers dedicated to addressing pressing environmental challenges. The ripple effects of early environmental education extend well beyond the classroom, contributing to a more sustainable and environmentally conscious society.

#### **Implications for Curriculum and Pedagogy**

Recent research on early childhood environmental education has yielded findings with substantial implications for the development of educational curricula and the evolution of pedagogical approaches (Stern et. al., 2014; Wilson, 1996; Wals & Benavot, 2017). These insights underscore the need for educational systems to adapt to the growing recognition of the profound impact of environmental education on young learners.

One prominent implication is the increasing integration of nature-based elements into early childhood education curricula. Curriculum designers are acknowledging the cognitive and emotional benefits that stem from exposure to natural environments. As a result, educational programs are incorporating outdoor experiences, nature walks, and hands-on activities in natural settings to provide children with direct encounters with the natural world. This shift aims to tap into the inherent curiosity and wonder that children exhibit when exposed to nature, thereby enhancing their learning experiences.

Complementing this shift is imperative for teacher training programs to equip educators

with the knowledge and skills required to effectively implement outdoor and nature-based learning activities. Educators are being prepared to facilitate meaningful experiences for young learners in natural settings, fostering a deeper connection between students and the environment. Training programs emphasize the importance of guidance and mentorship in outdoor education, enabling educators to create safe and engaging outdoor learning environments.

Furthermore, recent research underscores the interdisciplinary nature of early environmental education. It highlights the interconnectedness of environmental concepts with various subject areas, including science, mathematics, language arts, and social studies. Consequently, contemporary educational programs are moving towards integrating environmental themes and concepts into these subject areas, promoting a holistic understanding of the environment. This interdisciplinary approach not only enhances students' environmental literacy but also reinforces the relevance of environmental issues across multiple domains of knowledge.

Overall, it can be said that recent research on early childhood environmental education are reshaping educational practices. The integration of nature-based elements, teacher training in outdoor education, and the adoption of interdisciplinary approaches are transformative steps in nurturing environmentally conscious and well-rounded individuals. These developments reflect a growing recognition of the pivotal role early environmental education plays in preparing children to understand, appreciate, and protect the natural world.

#### Figure 4.

Aspects Of Implications for Future Curriculum Development and Pedagogical Approaches



In summary, recent research on early childhood environmental education underscores its positive impact on children's cognitive, emotional, and social development. It emphasizes the importance of nature exposure, outdoor classrooms, and a lifelong commitment to environmental stewardship. These findings inform the design of curricula and teaching practices that harness the potential of early environmental education to shape environmentally conscious and responsible citizens for the future.

#### **Overcoming Challenges and Barriers**

Early childhood environmental education, while immensely valuable, faces certain challenges and barriers that educators and advocates must address to ensure equitable access and effective implementation. This section explores key challenges and strategies for overcoming them.

#### Limited Outdoor Access in Urban Areas

**Challenge:** In urban environments, limited access to green spaces and natural settings poses a significant challenge to providing meaningful outdoor experiences for young children. High population density, limited parks, and safety concerns can hinder opportunities for nature-based learning.

#### Strategies for Overcoming the Challenge

- Urban Greening Initiatives: Encourage urban planning authorities to invest in creating green spaces and pocket parks within city limits. These spaces can serve as accessible outdoor classrooms.
- **Community Gardens:** Establish community gardens and urban farms, providing children with opportunities to interact with nature and learn about sustainable agriculture.
- Schoolyard Transformations: Transform schoolyards into nature-rich environments with trees, gardens, and wildlife habitats, creating accessible outdoor learning spaces.
- Nature Exploration Excursions: Organize field trips to nearby nature reserves, botanical gardens, and urban wildlife centers to expose urban children to natural environments beyond their immediate surroundings.

#### Addressing Cultural and Socioeconomic Disparities

**Challenge:** Cultural and socioeconomic disparities can lead to unequal access to early childhood environmental education. Some communities may lack resources or face cultural barriers that limit their engagement with nature-based programs.

#### Strategies for Addressing the Challenge

- **Culturally Relevant Curriculum:** Develop culturally inclusive and relevant curriculum materials that resonate with diverse communities, respecting their values and traditions.
- **Community Partnerships:** Collaborate with community organizations and leaders to bridge cultural gaps and build trust. Involve local community members

in program development and implementation.

- Scholarships and Subsidies: Offer scholarships and subsidies for children from underserved communities to ensure that financial constraints do not hinder their participation in environmental education programs.
- **Cultural Competency Training:** Provide training for educators to enhance their cultural competency, enabling them to better understand and address the needs of diverse learners.

#### **Building Support from Parents and Caregivers**

**Challenge:** Engaging parents and caregivers in early childhood environmental education programs can be challenging, as they may have limited awareness of the benefits or face time constraints.

#### Strategies for Building Support

- **Parent Workshops:** Organize workshops and informational sessions for parents and caregivers to educate them about the importance of early childhood environmental education and its positive impact on child development.
- **Home-Based Activities:** Provide parents with resources and ideas for naturebased activities they can incorporate into family routines, fostering a sense of continuity between home and school.
- **Parent-Teacher Partnerships:** Foster strong partnerships between educators and parents, encouraging open communication and collaboration in planning and implementing environmental education activities.
- **Community Events:** Organize family-oriented outdoor events, such as nature hikes, environmental clean-up activities, and gardening projects, to involve parents and caregivers directly in environmental education experiences.

In conclusion, while early childhood environmental education offers a host of benefits, it is crucial to acknowledge and address the challenges and barriers that may hinder its effective implementation. By creatively overcoming limitations in urban areas, fostering inclusivity and cultural sensitivity, and actively engaging parents and caregivers, educators and advocates can work toward ensuring that environmental education reaches all young learners, regardless of their background or circumstances.
#### Nature and Environmental Awareness Activities for Kids

#### **Activity 1: Nature Scavenger Hunt**

#### Aims:

- Foster a sense of wonder and curiosity about the natural world.
- Encourage children to explore and observe their environment.
- Develop basic observational and sensory skills.
- Promote a connection between children and their local natural surroundings.

#### Scope:

- Designed for ages 3-8, with adaptations for non-readers.
- Emphasizes hands-on exploration and discovery.
- Encourages outdoor play and active engagement with nature.
- **Philosophical Base:** This activity aligns with the philosophy that children are natural explorers and that learning about the environment should be an active and enjoyable experience. It supports the idea that early childhood environmental education should begin with simple, accessible activities that build a foundation for future environmental awareness and stewardship.

**Objective:** To encourage young children (ages 3-8) to explore nature and observe their environment.

#### Instructions:

- 1. Create a simple scavenger hunt checklist with pictures instead of words to make it accessible for non-readers. For example, include pictures of a flower, a leaf, a rock, a bird, and a butterfly.
- 2. Use colorful baskets or bags with handles to make it easier for younger children to carry and collect their finds.
- 3. Provide adult supervision to ensure safety and to assist younger children with their scavenger hunt.
- 4. Encourage older children (ages 6-8) to assist and guide the younger ones, fostering a sense of teamwork and responsibility.

#### Activity 2: Planting and Caring for a Garden

#### Aims:

- Introduce the concept of gardening and plant growth in a hands-on way.
- Cultivate a sense of responsibility for living things.
- Foster an understanding of the interdependence between plants and the environment.
- Encourage a connection to the natural world through gardening experiences.

#### Scope:

- Suitable for ages 3-8, with adaptations for younger children.
- Incorporates gardening as an immersive learning activity.
- Emphasizes the growth and care of living organisms.
- **Philosophical Base:** This activity is grounded in the philosophy that children learn best when they are actively involved in caring for and observing living things. It aligns with the idea that gardening connects children to the cycles of nature and fosters a sense of responsibility for the environment, promoting early environmental stewardship.
- **Objective:** To introduce young children (ages 3-8) to the concept of gardening and plant growth in a fun and engaging way.

#### **Instructions:**

- 1. Choose fast-growing plants or seeds that are easy to care for and maintain, such as sunflowers, marigolds, or beans.
- 2. Use larger pots or garden beds to accommodate the age group's smaller hands and make planting easier.
- 3. Supervise closely during planting and watering to ensure that young children handle soil and plants gently.
- 4. Incorporate storytelling and imaginative play into the activity by encouraging children to pretend to be garden fairies or scientists exploring plant growth.

## Activity 3: Wildlife Observation and Journaling

## Aims:

- Encourage children to observe and appreciate local wildlife and nature.
- Develop basic scientific observation skills.
- Cultivate empathy for living creatures and their habitats.
- Promote a sense of connection to the natural world.

## Scope:

- Designed for ages 3-8, with adaptations for different age groups.
- Utilizes simple tools like picture books and nature artboards.
- Focuses on building observational and descriptive abilities.

**Philosophical Base:** This activity is rooted in the philosophy that young children are natural observers and can develop a deep connection to the environment through close encounters with wildlife and nature. It aligns with the idea that early childhood environmental education should nurture children's curiosity about the natural world and encourage them to become compassionate and informed care-takers of the Earth.

These activities collectively emphasize experiential learning, hands-on exploration, and a child-centered approach to early childhood environmental education. They aim to lay the foundation for environmental awareness, curiosity, and stewardship from a young age, aligning with the philosophy that children are inherently connected to and influenced by their environment.

**Objective:** To engage young children (ages 3-8) in observing and appreciating local wildlife and nature.

## Instructions:

1. Use picture books or flashcards with images of common local wildlife species to help young children identify and understand what to look for.

2. Instead of traditional journals, provide young children with large sheets of paper or nature art boards for drawing pictures of what they see.

3. Encourage children to use their imagination to describe animals and their behaviors in simple language. For example, they can say, "I saw a big brown bird with a long beak" or "I saw a butterfly on a yellow flower."

4. Make observations fun by using animal-themed binoculars and magnifying glasses designed for children.

Adapting these activities for the 3-8 age group ensures that they are developmentally appropriate and enjoyable for younger children while still offering valuable nature and environmental experiences.

## Activity 4: Nature Art and Creativity

#### Aims:

- Encourage children to express their creativity through art while connecting with nature.
- Develop an appreciation for the beauty and diversity of the natural world.
- Promote sensory exploration of natural materials.
- Foster a sense of environmental stewardship through art and creativity.

## Materials Needed:

- Paper or cardboard
- Crayons, colored pencils, or markers
- Natural materials (leaves, twigs, pinecones, flowers, rocks)
- Glue or adhesive putty
- Optional: Watercolor paints and brushes

**Philosophical Base:** This activity aligns with the philosophy that creativity and art are powerful tools for connecting children to nature. It promotes the idea that appreciating the beauty of the environment can inspire care and stewardship. By incorporating natural materials into their art, children not only express their creativity but also deepen their connection to the natural world.

## **Instructions:**

- 1. Begin by discussing the importance of nature and its beauty. Talk about how nature can inspire art and creativity.
- 2. Take children on a nature walk to collect various natural materials like leaves, twigs, flowers, or rocks. Encourage them to explore their senses by touching, smelling, and observing these materials.
- 3. Provide each child with a sheet of paper or cardboard and art supplies (crayons, colored pencils, or markers).
- 4. Invite children to create nature-inspired art using the collected materials. They can glue leaves to their paper, make rubbings of textures they find, or draw pictures inspired by what they observed in nature.
- 5. For an added creative touch, offer watercolor paints and brushes for children to paint their natural materials or create watercolor backgrounds for their artwork.
- 6. While they work on their art, discuss their observations and thoughts about the natural world. Ask questions like, "What do you like about this leaf?" or "What did you learn from our nature walk?"
- 7. Once their art is complete, have a mini art show where children can share their creations, describing what inspired their work.

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## **About The Author**

**Elif OZTURK** earned her undergraduate degree from Middle East Technical University in 2005 before achieving her master's and doctoral degrees at Hacettepe University. She currently holds the position of associate professor at the Department of Early Childhood Education, Faculty of Education, Giresun University. In addition to advising on numerous theses in higher education, she has also authored numerous research articles and books discussing the topics of childhood and elementary school education.

She has researched early childhood education institutions in various countries and has encountered diverse educational philosophies and approaches. Her ongoing research on early childhood education extends both within Turkey and internationally. In addition, the academician has received awards, including the Science Service Award for her work on developing environmental awareness in children and training environmentally literate educators, presented by Akdeniz University in Turkey in 2022. Her research covers interdisciplinary topics such as children, environment, and nature, learning approaches for children, and children's science education. Elif Öztürk, an academician with a strong belief in the significance of early childhood education, is steadfast in her commitment to furthering developments in this field.

# **CHAPTER 4**

# **Environmental Education in Education Programs**

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#### Introduction

Since the beginning of time, humans have engaged in interactions with the environment. Although the primary goal of this contact was the individual's own gain, it has since changed into an endeavor to manage and control. Humans have begun to encounter environmental issues as a result of their careless exploitation of the environment, which has resulted in devastating damage. The prevalence of these issues has increased as a result of advances in science and technology, particularly in light of the effects of industrialization. The need for food, energy, raw resources, and shelter, as well as the rapid growth of the human population, have all contributed to the challenges' rapid expansion.

Scientists have increased public awareness of the environment and environmental problems as a result of this historical increase in environmental problems. The goal is to raise the proportion of people who are highly aware of the environment. This is so that people can develop the required attitudes and behaviors toward the environment, which are part of environmental consciousness (Erten, 2004). People who have attained this consciousness have high levels of environmental awareness, the ability to comprehend, feel, and know their surroundings, as well as knowledge of the moral standards and regulations that govern the environment (Atasoy, 2006). Successful environmental education can lead to the emergence of these people (Atabek Yigit, 2009).

The first time environmental education was mentioned was in 1948 at the IUCN conference in Paris (Palmer, 1998). A consensus was reached on methods of environmental education and the broad objectives of environmental education twenty-four years later at

the United Nations conference on Man and the Environment in Stockholm. By providing environmental education to adults and the new generation, a declaration was produced (IUCN, 1972). According to Grodziéska-Jurczak et al. (2006) and the IUCN (1972), environmental education is a protracted process through which people develop the essential knowledge, abilities, and attitudes in respect to their biophysical and cultural environments. Given this concept, it is thought to be crucial to provide environmental education at all levels, beginning in the home.

As a result of this knowledge, our nation's curricula now include environmental education gains and modules. In elementary school, social studies, science, and life science curricula all include learning objectives and units for environmental education. It is covered in biology, physics, chemistry, and geography classes in secondary school. Physical education, visual arts, religious culture, and ethical courses are taught in primary schools. Environmental education is mentioned in many course groups in secondary schools. The inclusion of environmental education in the curricula of the more intensively integrated courses will be considered on a program basis in this part, nevertheless.

### **Environmental Education in Primary Education**

Children are intended to learn about sustainability and the environment through environmental education at the primary school level (Gulersoy et al., 2020; Senemoglu, 1997). In the context of this goal, the curriculum is also taken into account. Children's understanding of environmental protection and how to create a sustainable future are intended benefits of this type of teaching. After reviewing the literature, the following categories of fundamental knowledge concerning environmental education in primary school can be made (Alim, 2006; Demir & Yalcin, 2014; Tanriverdi, 2009);

- 1. Scope: Children's comprehension of environmental challenges and adoption of the values of sustainability and nature conservation are the primary goals of environmental education.
- 2. Content: Environmental education covers a range of subjects, including biodiversity, climate change, waste management, energy conservation, and comprehending environmental challenges.
- 3. Learning Methods: Rather than relying solely on texts, environmental education promotes learning through experiences. It is possible to provide students with hands-on learning opportunities including nature hikes, field trips, nature observation, recycling initiatives, and environmental projects.
- 4. Participation: Students actively engage in conversations and exchanges as part of the environmental education learning approach. It gives pupils the chance to become sensitive to environmental issues and to come up with solutions.
- 5. Collaboration: Students are encouraged to work together through environmental

### Environmental Education in Education Programs

education. As a result, they are better able to comprehend the complexity of environmental issues and collaborate when looking for solutions.

- 6. Values and Attitudes: Environmental education aids children in forming virtuous attitudes and values for the natural world. These attitudes include a sense of obligation, consideration for the environment, and a love of the natural world.
- 7. Interdisciplinary Approach: Environmental education adopts an interdisciplinary strategy that integrates several academic disciplines, including science, math, the social sciences, and the arts. This guarantees that environmental subjects are included throughout the curriculum.
- 8. Sustainability: Environmental education highlights the value of using resources to satisfy the requirements of future generations while teaching pupils the concept of sustainability.

Environmental education aims to develop environmentally-conscious children who will help create a more sustainable future. It motivates students to appreciate nature more, protect it, and preserve a livable environment for future generations.

## **Environmental Education in Science**

2018 Science Curriculum in the special objectives section of the science curriculum (Ministry of National Education [MEB], 2018a);

- To provide basic knowledge about astronomy, biology, physics, chemistry, earth and environmental sciences, science and engineering applications,
- To adopt scientific process skills and scientific research approach in the process of exploring nature and understanding the relationship between human and environment, and to produce solutions to the problems encountered in these areas,
- To recognize the interaction between the individual, the environment and society; to develop awareness of sustainable development of society, economy and natural resources,
- To take responsibility for daily life problems and to use science knowledge, scientific process skills and other life skills to solve these problems,
- To arouse interest and curiosity about the events occurring in nature and its immediate surroundings and to develop attitudes,

through its goals, environmental education makes a direct and indirect point about how important it is.

When the curriculum is looked at, achievements in environmental education begin



in the third grade. The "Human and Environment" unit is featured, particularly in the 4th and 5th grade levels. It is mentioned in many subject-area units in other grade levels. It is clear from the context that this level only directly units environmental education.

In the 2018 Science Curriculum, the acquisitions and units related to environmental education at the grade levels were examined in detail. Information about the 3rd grade science course is given in Table 1.

#### Table 1

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Class	Unit Name	Subject	Acquisitions
	Journey to the World of Living Things	Recognize the Things Around Us	*Classifies living and non- living things using examples from their environment.
			*Presents the results of observation of the life cycle of a plant.
	Journey to the World of Living	Me and My Environment	*Recognizes the environment they live in.
3RD	Things		*Takes an active role in cleaning the environment.
G R			*Explains the differences between natural and
A			*Designs an artificial
D			environment.
E			*Realizes the importance of the natural environment for living things.
			*Proposes solutions by doing research to protect the natural environment.
	Electric Vehicles	Electricity Sources	*Discusses the damages of battery waste to the environment and what to do about it.

Information for 3rd Grade Science Course

There are seven units and 36 acquisitions in the science curriculum for the third grade. Nine of these acquisitions are thought to be connected to environmental education. At this grade level, it was calculated that the advances in environmental education were 19.45%. Table 2 contains details about the scientific curriculum for the fourth grade.

Class	Unit Name	Subject	Acquisitions
	Lighting and Sound	Light Pollution	*Question the causes of light pollution.
	Technologies		*Explains the negative effects of light pollution on natural life and observation of celestial objects.
			*Produces solutions to reduce light pollution
4TH G	Lighting and Sound Technologies	Sound Technologies from Past to Present	*Researches the positive and negative effects of technological tools with loud sound.
R A	Lighting and Sound	Sound Pollution	*Question the causes of sound pollution.
D E	Technologies		*Explains the negative effects of sound pollution on human health and the environment.
			*Produces solutions to reduce sound pollution.
	Human and Environment	Conscious Consumer	*Demonstrates care to be economical in the use of resources.
			*Recognizes the importance of recycling and the resources necessary for life.

# Table 2

Information for 4th Grade Science Course

There are seven units and 46 acquisitions in the science curriculum for the fourth grade. Nine of these acquisitions are thought to be connected to environmental education. The benefits in environmental education were calculated at this grade level to be 19.57% proportionally. Table 3 contains details about the fifth-grade science curriculum.



## Table 3

Information for 5th Grade Science Course

Class	Unit Name	Subject	Acquisitions
	Human and Environment	Biodiversity	*Question the importance of biodiversity for natural life.
			*Discusses the factors that threaten biodiversity based on research data.
<b>5</b> TH	Human and Environment	Human and Environment Relationship	*Expresses the importance of the interaction between human and environment.
G R A D E			*Offers suggestions for the solution of an environmental problem in his/ her immediate environment or in our country.
			*Makes inferences about environmental problems that may occur in the future as a result of human activities.
			*Discusses benefit and harm situations in human-environment interaction on examples.

When the fifth grade science curriculum is examined, there are 36 acquisitions and seven units in total. It is seen that six of these acquisitions are related to environmental education. Proportionally, it was determined that the gains related to environmental education were 16.66% at this grade level. Information about the 6th grade science course is given in Table 4.

## Table 4

Information for 6th Grade Science Course

Class	Unit Name	Subject	Acquisitions
6TH	Matter and Heat	Density	*Discusses the importance of this situation for living things by comparing the densities of solid and liquid states of water.
G R A D	Matter and Heat	Matter and Heat	*Discusses the importance of thermal insulation in buildings in terms of family and national economy and effective use of resources.
Ε	Matter and Heat	Fuels	*Discusses the effects of the use of different types of fuels for heat on human and environment

When looking at the sixth grade science curriculum, there are 59 acquisitions and seven units in all. Three of these acquisitions are associated with environmental education. The improvements connected to environmental education were calculated



to be 5.08% at this grade level. Table 5 contains information on the 7th grade science subject.

## Table 5

Information for 7th Grade Science Course

Class	Unit Name	Subject	Acquisitions
	The Solar System and Beyond	Space Exploration	*Expresses the causes of space pollution and predicts the possible consequences of this pollution.
7TH G R A D E	Pure Matter and Mixtures	Domestic Waste and Recycling	<ul> <li>*Distinguishes recyclable and non-recyclable materials in household wastes.</li> <li>*Designs a project on recycling of domestic solid and liquid wastes.</li> <li>*Questions recycling in terms of effective use of resources.</li> <li>*Pay attention to waste control in their immediate environment.</li> </ul>
	Interaction of Light with Matter	Absorption of Light	*Gives examples of innovative applications of solar energy in daily life and technology.

Examining the scientific curriculum for the seventh grade reveals a total of seven units and 67 acquisitions. Six of these acquisitions are thought to be connected to environmental education. At this grade level, it was calculated that the gains related to environmental education were 8.95%. Table 6 contains details about the eighth-grade science curriculum.



## Table 6

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Information for 8th Grade Science Course

Class	Unit Name	Subject	Acquisitions
	DNA and The Genetic Code	Biotechnology	*Discusses the dilemmas created within the scope of biotechnological applications and the beneficial and harmful aspects of these applications for humanity.
	Matter and Industry	Acids and Bases	*Provides solutions for the prevention of acid rain.
	Energy Conversions and Environmental Science	Material Cycles and Environmental Problems	*Discusses the causes and possible consequences of global climate change.
	Energy Conversions and	Sustainable Development	*Demonstrates care to be economical in the use of resources.
8TH	Environmental Science		*Designs a project for the economical use of resources.
G R A			*Explains the importance of separating solid wastes for recycling.
D E			*Offers solutions by using research data on the contribution of recycling to the national economy.
			*Suggests solutions by stating the problems that may be encountered in the future if resources are not used economically.
	Electric Charges and Electric Energy	Transformation of Electrical Energy	*Generates ideas about the advantages and disadvantages of power plants.
			*Discusses the importance of conscious and economical use of electrical energy in terms of family and national economy.
			*They take care to use electricity economically at home.

When the eighth grade science curriculum is examined, there are 61 acquisitions and seven units in total. It is seen that 11 of these acquisitions are related to environmental education. Proportionally, it was determined that the gains related to environmental education were 18.03% at this grade level.

#### **Environmental Education in Secondary Education**

Science courses at secondary level have a great potential for environmental education. These courses provide students with the opportunity to develop an in-depth understanding of environmental issues and develop skills to find solutions to environmental problems (Bowers & Creamer, 2021; Rickinson, 2001; Zachariou et al., 2020).

Environmental education for students has a lot of potential in secondary science courses. These classes can help develop students into thoughtful, informed, and problem-solving persons who are sensitive to environmental issues. When the secondary school biology course curriculum is studied in light of this information, environmental education acquisitions and units are evident. Table 7 contains details on the ninth-grade biology subject.

#### Table 7

Class	Unit Name	Subject	Acquisitions
	Living World	Diversity and Classification of Living Things	*Explains the importance of classification in understanding the diversity of living things.
9TH G R			
A D E	Living World	Living Worlds and Their Properties	*Explains the contributions of living organisms to biological processes, economy and technology with examples.
			*Explain the general characteristics of viruses.

Information for 9th Grade Biology Course (MEB, 2018b)

When the ninth grade biology curriculum is examined, there are 11 acquisitions and three units in total. It is seen that three of these acquisitions are related to environmental education. Proportionally, it was determined that the gains related to environmental education were 27.27% at this grade level. Information about the 10th grade biology course is given in Table 8.



## Table 8

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Class	Unit Name	Subject	Acquisitions
	Ecosystem Ecology and Current Environmental Problems	Ecosystem Ecology	*Explains the relationship between living and non-living components of the ecosystem. *Analyzes the flow of matter and energy in ecosystems. *Establishes a relationship between material cycles and sustainability of life.
10TH G R A D E	Ecosystem Ecology and Current Environmental Problems	Current Environmental Problems and Human	*Evaluates the causes and possible consequences of current environmental problems. *As an individual, he/she questions his/her role in the emergence of environmental problems. *Suggests solutions to prevent environmental pollution in local and global contexts
	Ecosystem Ecology and Current Environmental Problems	Natural Resources and Biodiversity Protection	*Explains the importance of sustainability of natural resources. *Question the importance of biological diversity for life. *Suggests solutions for the protection of biological diversity.

Examining the biology curriculum for the tenth grade reveals that there are three units and a total of 17 acquisitions. Nine of these acquisitions are thought to be connected to environmental education. At this grade level, it was calculated that the improvements in environmental education were 52.94% higher proportionately. Table 9 contains details about the biology course for the eleventh grade.

### Table 9

Class	Unit Name	Subject	Acquisitions
11TH G R A D E	Community and Population Ecology	Community Ecology	*Explains the factors affecting the structure of the community. *Explains the competition within and between species in the community with examples. *Explains symbiotic relationships between species in a community with examples. *Explains succession in communities with examples.
	Community and Population Ecology	Population Ecology	*Analyzes the factors affecting population dynamics.

Information for 11th Grade Biology Course

There are two units and 34 acquisitions in the biology curriculum for the eleventh grade. Five of these acquisitions are thought to be connected to environmental education. At this grade level, it was calculated that the gains related to environmental education were 14.71%. Table 10 contains details about the biology course for the 12th grade.

### Table 10

information for 12th Grade Diology Cours	Informatic	n for	12th	Grade	Biology	Cours
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Class	Unit Name	Subject	Acquisitions
	From Gene to Protein	Genetic Code and Protein	*Explain the concepts of genetic engineering and biotechnology.
Synthesis 12TH G R	Synthesis	*Evaluates the impact of genetic engineering and biotechnology applications on human life.	
K A D E	Living Things and Environment	Living Things and Environment	*Explains the effect of environmental conditions on the continuity of genetic changes.
			*Gives examples of artificial selection applications in agriculture and animal husbandry

When the twelfth grade biology curriculum is examined, there are 29 acquisitions and four units in total. It is seen that four of these acquisitions are related to environmental education. Proportionally, it was determined that the gains related to environmental education were 13.79% at this grade level.Examining the chemistry course curriculum reveals acquisitions and units pertaining to environmental education. Table 11 provides details on the ninth-grade chemistry curriculum.

#### Table 11

Class	Unit Name	Subject	Acquisitions	
9TH G R A D E	Chemical Science	Occupational Health and Safety in Chemical Practice	*Explains the effects of chemical substances on human health and the environment.	
	States of Matter	Physical States of Matter	*Explains the importance of matter in different states for living things and the environment.	
	Nature And Chemistry	Water and Life	*Explains the importance of water for beings.	
			*Develops solutions for saving water and protecting water resources.	
	Nature And Chemistry	Environmental Chemistry	*Explains chemical pollutants that cause air, water and soil pollution.	
			*Suggests solutions to reduce the effects of chemical pollutants that harm the environment.	

Information for 9th Grade Chemistry Course (MEB, 2018c)

Current Studies in Environmental Education

Examining the chemistry curriculum for the ninth grade reveals a total of five units and 38 acquisitions. Six of these acquisitions are thought to be connected to environmental education. The benefits in environmental education were calculated at this grade level to be 15.79% proportionally. Table 12 contains details on the chemistry course for students in the tenth grade.

## Table 12

Infe	ormation	for	10th	Grade	Chemistrv	Course

Class	Unit Name	Subject	Acquisitions	
	Acids, Bases and Salts	Reactions of Acids and Bases	* Explains important reactions of acids and bases in terms of daily life.	
	Acids, Bases and Salts	Acids and Bases in Our	*Explains the benefits and harms of acids and bases.	
10TU		Lives	*Explains the health and safety precautions to be taken when working with acids and bases.	
G R	Chemistry Everywhere	Common Daily Life	*Explains the properties of cleaning agents.	
A D		Chemicals	*Gives examples of the usage areas of common polymers.	
E			*Explains the contribution of recycling of polymer, paper, glass and metal materials to the national economy.	
			*Explain the harmful chemicals that cosmetic materials may contain.	
			*Explain the reasons for the use of drugs in different forms.	

When the tenth grade chemistry curriculum is examined, there are 23 acquisitions and four units in total. It is seen that eight of these acquisitions are related to environmental education. Proportionally, it was determined that the gains related to environmental education were 34.78% at this grade level. When the 11th grade units and acquisitions were analyzed, it was determined that there was no emphasis on environmental education. Information on the 12th grade chemistry course is given in Table 13.

**Environmental Education in Education Programs** 

Class	Unit Name	Subject	Acquisitions	
12T H G R A D E	Chemistry and Electricity	Corrosion	*Explain the electrochemical basis of corrosion prevention methods.	
	Energy Resources and Scientific Developments	Fossil Fuels	*Suggests solutions to reduce the harmful effects of fossil fuels on the environment.	
	Energy Resources and Scientific Developments	Alternative Energy Sources	*Recognizes alternative energy sources.	
			*Evaluates the use of nuclear energy in terms of science, society, technology, environment and economy.	
	Energy Resources and Scientific Developments	Sustainability	*Explains the importance of sustainable life and development for society and environment by associating it with chemistry	
	Energy Resources and Scientific Developments	Nanotechnology	*Evaluates the developments in the field of nanotechnology in terms of their effects on science, society, technology, environment and economy.	

## Table 13

Information for 12th Grade Chemistry Course

When looking at the twelfth grade chemistry curriculum, there are 31 acquisitions and four units in all. Eight of these acquisitions are associated with environmental education. At this grade level, the improvements attributable to environmental education were calculated to be 19.35%.

#### **Environmental Education in Life Science**

The Life Science Curriculum is based on the General Objectives and Basic Principles of Turkish National Education as stated in Basic Law No. 1739 on National Education. The program's fundamental goal is to grow persons who know themselves, live a healthy and safe existence, internalize the values of the society in which they live, are sensitive to nature and the environment, research, produce, and love their nation (MEB, 2018). Some of the specific objectives of the life science course are as follows;

- Recognizes himself/herself and his/her environment.
- Develops the ability to use resources efficiently.
- Be sensitive to nature and the environment.

When the acquisitions and units for environmental education in the Life Sciences course are examined, it is seen that it is included both on the basis of the unit and on the basis of the acquisitions. Information on the 1st, 2nd and 3rd grade life science course is given in Table 14.



## Table 14

Class	Unit Name	Acquisitions		
	Life at Home	*Uses resources at home efficiently.		
1ST G R A D E	Life in Nature	*Observes the animals in their immediate surroundings. *Observes the plants in their immediate surroundings. *Takes care to protect the animals and plants in their immediate surroundings. *Be sensitive about keeping nature and the environment clean. *Recognizes materials that can be recycled.		
2ND G R A D E	Life in Nature	<ul> <li>*Compare the conditions necessary for the survival of plants and animals.</li> <li>*Recognizes the importance of growing plants and feeding animals.</li> <li>*Gives examples of the effects of natural elements in the immediate environment on human life.</li> <li>*Contributes to the recycling of consumed materials.</li> <li>*Recognizes natural phenomena.</li> <li>*Gives examples of natural disasters.</li> <li>*Explains the precautions that can be taken against natural events and natural disasters.</li> </ul>		
100	Life at Home	*They fulfill their duties and responsibilities at home. *Makes original suggestions for effective and efficient use of resources at home.		
G B B C C C C C C C C C C C C C C C C C		*Introduces the features of historical, natural and touristic places in the immediate vicinity.		
A D E	Life in Nature	*Understands the importance of plants and animals in terms of human life. *Takes responsibility for protecting nature and the environment. *Gives examples of the contribution of recycling to himself/herself and the environment he/she lives in.		

Information for 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> Grade Life Science Course (MEB, 2018d)

When looking at the first grade life science curriculum, there are 53 acquisitions and six units in all. Six of these acquisitions are associated with environmental education. At this grade level, the improvements attributable to environmental education were calculated to be 11.32%. When the second grade curriculum is analyzed, 50 acquisitions and six units are discovered. Seven of these acquisitions were linked to environmental education (14%). Finally, when the third grade is examined, 45 acquisitions and six units are identified. Six acquisitions are related to environmental education at this grade level (13.33%).

## **Environmental Education in Social Studies**

Social Studies Curriculum and students;

- To recognize the general geographical features of the world and the environment in which they live, to explain the interaction between human beings and the environment and to develop their ability to perceive space,
- To realize the limitations of the natural environment and

resources, to try to protect natural resources with environmental sensitivity and to have a sustainable environmental understanding,

Environmental education is directly included in its specific objectives. From the fourth to the eighth grade, units and acquisitions for environmental education are included in the curriculum. Information on environmental education in the 4th to 7th grade curriculum is given in Table 15.

#### Table 15

Information on environmental education in the curriculum from 4th to 7th grade (MEB, 2018e)

Class	Unit Name	Acquisitions	Environmental Education Acquisitions(%)
4TH G R A D E	People, Places and Environments	*Distinguishes natural and human elements in the environment they live in. *Makes necessary preparations for natural disasters.	
	Science, Technology and Society	*Uses technological products without harming themselves, others and nature.	18.18%
	Production, Distribution and Consumption	*Distinguish between wants and needs and make conscious choices between the two. *Exhibits conscious consumer behavior as a responsible individual. *Uses the resources around them without wasting them.	
5TH G R A D E	People, Places and Environments	*Explains the landforms of the place and its surroundings on maps in general. * Explains the effects of climate on human activities by giving examples from daily life. *Gives examples of the effects of natural features and human features on population and settlement. *Question the causes of disasters and environmental problems in their environment. *Explains the effects of natural disasters on community life with examples.	15.15%
6TH G R A D E	People, Places and Environments	*Describes the geographical location of the continents, oceans and our country using concepts related to location. *Examines the basic physical geography features of Turkey's landforms, climate characteristics and vegetation on the relevant maps. * Shows the basic human geography features of Turkey on the relevant maps. *Makes inferences about climate characteristics based on human experiences in different natural environments of the world.	11.76%
7TH G R A D E	People, Places and Environments	*Makes inferences about the factors affecting settlement from past to present through case studies. *Discusses the causes and consequences of migration through case studies.	6.45%

#### Conclusion

When the acquisitions in the curricula are analyzed, it is discovered that the fourth grade has the highest amount of environmental education in the scientific course. In terms of the amount of acquisitions, it was concluded that the eighth grade had the most. In their study, Erten et al. (2022) also found that this grade level has the highest number of achievements in the science curriculum of our country. The sixth grade was discovered to have the lowest amount of attention on environmental education, both proportionally and in terms of the number of objectives. There are 305 acquisitions in the science course at the primary school level. 44 of these acquisitions were found to be relevant to environmental education. This means that the program covers 14.43% of the environmental education acquisitions. On the basis of rate and number, it is seen that the emphasis on environmental education is quite low. The fact that it is high at certain grade levels and low at others reveals many deficiencies in terms of achieving the purpose of environmental education (Artun, 2013). Preventing the increase in environmental problems encountered today or preventing the emergence of these problems can be achieved directly through environmental education. This can be achieved by increasing both the number of achievements and the number of qualified units in the curriculum. When the acquisitions related to environmental education at the secondary education level were analyzed, it was determined that 21 acquisitions out of a total of 91 acquisitions in the biology course were related to environmental education. It constitutes 23.08% of the acquisitions in the biology curriculum. In chemistry course, 22 acquisitions out of 127 learning outcomes are related to environmental education, which represents 17.32% of the total acquisitions. Both curricula emphasize environmental education more than the science course at the primary education level. This could indicate that environmental education, which should be provided earlier in stage, is not adequately covered in the curriculum. Environmental education is represented by 19 of the 148 learning outcomes in the life science course. This accounts for 12.84% of the total results. Environmental education was found to be associated to 17 out of 131 outcomes in the social studies course. This accounts for 12.98% of the entire outcome. It might be argued that environmental education is undervalued in both life science and social studies courses at the primary level. Looking at the courses reviewed within the scope of the study, it is clear that the life science course places the least emphasis on environmental education. When the course content is studied, it is clear that there are numerous courses and units relevant to the environment, but achievement levels have remained low. It is suggested that all courses, particularly this one, be examined in this context (Bahar et al., 2013).

Curricula include environmental education acquisitions and units. However, due to the density of curricula and other factors, environmental education is not given adequate attention. Subjects at specific grade levels are regarded to generate weaknesses in both theory and practice when placed in a course. The necessity for a distinct course on environmental education is evident in this setting. With good environmental education, we can remove or prevent the environmental challenges that we will face today and in the future. In light of this information, a committee comprised of governmental officials and relevant scientists (Ozkaya, 2021) can be constituted to add to the achievements in the field.

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# **CHAPTER 5**

# Environmental Education as a Transdisciplinary Process

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#### Introduction

Our world has been changing since the beginning, however, during the last two centuries the rate of this change is rapidly increasing. This acceleration has been linked to increasing human population, industrialization and growth in consuming fossil fuels due to this industrialization, and etc. Unfortunately, resources of Earth, our lovely one and only planet, are limited. In order to sustain humankind and other living things' existence on Earth, we depend on these limited resources. By the industrialization revolution, these limited resources have been spent at an accelerated speed and increasing volume. Additionally, consumption of resources revealed increase in percentage of greenhouse gasses in the atmosphere, loss of biodiversity, decrease in amount and quality of freshwater resources, increase in acidity of oceans, immigrating human populations and living species, pandemics and epidemics, changing temperature differences around the world and so unpredictable and extreme weather events, global climate change, and many other consequences.

New generations will face many wicked environmental problems, in order them to understand and solve these problems, consequently, be resilient and sustain their lives, they should be educated environmentally. As educators, we tend to offer education to be the solution to serious problems of society, however, critically this standpoint is not the most appropriate way always and for every instance. Since environmental problems are multi-dimensional in both reasons and results, they should be handled considering these dimensions. As environmental issues are complex and interconnected, traditional disciplinary boundaries can often limit our understanding and capacity to address pressing environmental issues effectively. Transdisciplinary environmental education (TEE) offers a holistic perspective that transcends traditional disciplinary boundaries.

Transdisciplinary Environmental Education (TEE) is a dynamic and evolving field of environmental education. It encourages the convergence and integration of knowledge, perspectives, and methodologies from various disciplines, transcending traditional academic boundaries. Additionally, TEE emphasizes an integrated understanding of environmental issues, fostering collaborative problem-solving, critical thinking, and an appreciation for the interrelated nature of ecological, social, economic, and political aspects of environmental challenges (Sterling, 2001).

## **Understanding Transdisciplinary Environmental Education**

Environmental education as a transdisciplinary process is an integrated way of thinking that internalizes the multidimensional nature of environmental issues (Capra, 2002). It welcomes the contributions of diverse knowledge domains and the active participation of students in real-world problem-solving (Sterling, 2001).

Environmental issues are multidimensional and often require an integrated perspective. For instance, addressing climate change requires not only scientific insights but also socio-political awareness, economic strategies, and ethical considerations. Conventional, single-discipline education often could not prepare students to cope with the complexity of these challenges. Addressing such complex challenges necessitates an educational approach that equips learners with the knowledge and skills to think across disciplines (Orr, 1992). In this context, TEE can respond to the need for a more comprehensive and integrative approach to environmental education (Wals, 2014).

## Key principles of TEE

**Community Involvement**: Non-Governmental Organizations (NGOs), governmental agencies, and community members often collaborate with students and teachers in TEE. Collaboration with them creates a sense of shared responsibility and global citizenship (Brown & Green, 2020; Rickinson et al., 2004), deepens students' connection to and practical understanding of environmental challenges (Gruenewald, 2003).

**Interdisciplinarity**: TEE integrates diverse disciplines and epistemologies to address environmental issues (Higgs & McAllister, 2006). It asks students to utilize knowledge and perspectives from a wide range of disciplines, including biology, sociology, economics, and political science, to discover and propose solutions to environmental problems (Capra, 2002; Smith, 2018).

**Engagement**: Students' active involvement in real-world environmental issues is central to TEE. This often encompasses experiential learning, fieldwork, and internships (Jones, 2019; Wals & Jickling, 2002). Students actively participate in realistic

environmental issues, by this way they gain practical experience and a deeper connection to the problems they are investigating (Gruenewald, 2003).

**Sustainability Focus**: TEE emphasizes sustainability and the need for long-term solutions to environmental challenges (Adams, 2017). Additionally, it emphasizes the integration and balancing of ecological, social, and economic dimensions in students' decision–making about and solutions to environmental issues (Sterling, 2010).

**Critical Thinking**: TEE improves students' critical thinking skills, so that it enables students to analyze and evaluate complex environmental issues and suggest creative and well-thought solutions (Williams, 2021; Orr, 1992; Sterling, 2010).

### Implementing transdisciplinary environmental education

In order to implement TEE, education should be open to innovative ways of instruction. TEE curriculum should integrate various subjects, topics and cross-disciplinary collaborative approaches. In other words, educators should collaborate across disciplines to create an engaging and holistic program. Topics should cover both local and global environmental issues, so that they foster students to broaden their perspective (Johnson & White, 2019). TEE requires the development of interdisciplinary curricula that benefit from multiple knowledge domains (Breiting et al., 2005).

Field trips, internships, hands-on and outdoor activities are essential components of TEE (Russ, 2008). These experiences help students connect theory with practice and develop a sound appreciation for nature (Brown, 2020).

TEE often centers on solving real-world problems. Students work on projects that address urgent, multi-dimensional and realistic environmental issues, encouraging critical thinking and collaboration with other stakeholders, community members, scientists, NGOs, and etc. (Sobel, 2004). This problem-based learning experiences engage students in solving real-world environmental problems, cultivate their critical thinking and ability to collaborate and work cooperatively (Smith & Johnson, 2018).

TEE is not implemented in classrooms only; it extends beyond the classroom. Collaborating with local communities, environmental organizations, and government agencies and other stakeholders ensures that students understand the practical implications of their education. Therefore, by this collaboration, all related stakeholders provide practical insights and solutions in TEE programs (Green & Adams, 2021), and the practical relevance of TEE programs are strengthened (Gruenewald, 2011).

Evaluation methods should go beyond traditional exams. TEE outcomes should be evaluated through a variety of assessment methods, including alternative methods such as portfolios, presentations, and reflective essays. These assessment techniques will reflect the holistic nature of TEE (Wals & Jickling, 2002; Williams & Jones, 2019).

#### The benefits of transdisciplinary environmental education

TEE equips students with a holistic understanding of environmental issues, enabling them to address complex problems (Brown & Smith, 2022).

Students become active agents of change, gaining the knowledge and skills to contribute meaningfully to sustainability efforts. (Johnson & Green, 2020).

TEE fosters a sense of responsibility for the entire ecosystem by emphasizing ecological, social, and economic systems are all interconnected to each other (Adams & White, 2017).

TEE makes students gain important and essential skills which are highly applicable to professional fields such as environmental science, policy, and advocacy (Williams, 2020).

In TEE, students acquire a lifelong commitment to sustainability, so they choose an appropriate way of life and behave consistently this way and with sustainability beyond the classroom (Smith & Brown, 2019).

#### Student and teacher roles in a transdisciplinary environmental education

In a transdisciplinary environmental education (TEE) setting, the learning environment should be dynamic and effective; a great emphasis is given to holistic thinking, active engagement in especially problem solving, and collaboration. In TEE, students and teachers engage actively in the learning process. Consequently, students can become informed, responsible, and proactive citizens while they are facing the challenges and opportunities introduced by the multidimensional world of environmental education.

#### Student Roles:

Active Learners: Students engage in fieldworks, problem-solving exercises, projects, hand-on activities, hence, they are active learners. They consult stakeholders' views and standpoints and apply their knowledge to exploration and investigation of problematic real world environmental problem cases (Sterling, 2001).

Critical Thinkers: In TEE students ought to handle environmental challenges critically. They evaluate information from various sources, analyze data, and develop well-reasoned solutions to multidimensional problems (Orr, 1992).

Interdisciplinary Explorers: Students make use of and integrate knowledge from scientific, social, economic and political and other related disciplines, taking into consideration the views of all participants to acquire a holistic and comprehensive understanding of wicked environmental problems (Capra, 2002).

Collaborators: Collaboration is a central aspect of TEE. Students often work in groups to investigate environmental problems, this cooperative investigation promotes communication and cooperation. They learn to appreciate the value of diverse perspectives and shared responsibility (Wals & Jickling, 2002).

Problem-Solvers: In TEE, students are problem-solvers. They define, analyze, and develop solutions for real-world environmental issues, contributing to the development of sustainable solutions (Rickinson et al., 2004).

Community Engagers: TEE involves engagement with related stakeholders such as local communities, NGOs, and government agencies. Students connect with stakeholders to gain practical insights into environmental issues and work collaboratively towards solutions, improving a sense of local and global citizenship (Gruenewald, 2003).

Reflective Practitioners: Students show a reflective perspective towards their learning experiences. They maintain journals, create portfolios, and participate in discussions about the ethical, cultural, and social dimensions of environmental issues (Wals, 2014).

Teacher Roles:

Facilitator: Teachers in TEE act as facilitators rather than information providers. They create a learning environment where students are encouraged to explore, question, and discover. Teachers guide the learning process and encourage critical thinking (Sterling, 2001).

Mentor: Teachers guide students' learning process as mentors. They give advice on research methodologies, problem-solving strategies, and ethical considerations in environmental education (Wals, 2014).

Collaborator: Teachers work collaboratively with students in projects to address environmental issues, facilitating the integration of diverse perspectives and knowledge domains (Rickinson et al., 2004).

Resource Provider: Teachers provide students with the necessary resources, including access to scientific literature, educational materials, and tools for data analysis. They help students to navigate and to make sense of complex information (Gruenewald, 2003).

Community Communicator: Teachers establish connections with local communities, environmental organizations, and governmental bodies. They support students for community engagement and ensure that projects are relevant to real-world issues (Gruenewald, 2003). Assessor: Teachers evaluate students' improvement with diverse methods, such as project evaluations, presentations, and reflective essays. These assessments measure students' critical thinking ability and problem solving competencies (Wals & Jickling, 2002).

Role Model: Teachers exhibit environmentally responsible behaviors and ethical decision-making. They constitute positive models by behaving in accordance with the values of sustainability, environmental stewardship, and global citizenship (Sterling, 2001).

#### Assessment in a transdisciplinary environmental education

Assessment in transdisciplinary environmental education (TEE) should align with the program's goals and principles. Since TEE emphasizes holistic understanding, problemsolving, and critical thinking, assessment methods should capture these aspects.

1. Portfolio Assessment: Students prepare portfolios that indicate their learning. Reflections, projects, artifacts, and etc. can be included in these portfolios. These student products show students' improvement in critical thinking and practical application of multidimensional knowledge gained through communication and collaboration with various stakeholders of real-world environmental issues (Darling-Hammond & Snyder, 2000).

2. Project-Based Assessment: Projects about ill-structured environmental problems are led by students. Assessment criteria are the quality, interconnectedness and integration of various disciplines and the projects' impact on the faced environmental problem (Thomas, 2000).

3. Peer and Self-Assessment: Students organize and monitor their learning and gain a deeper understanding about the strengths and weaknesses of themselves and their peers through peer and self-assessments. They give feedback both to themselves and their peers in order to sustain improvement in environmental education (Falchikov, 2013).

4. Case Studies and Problem-Solving Scenarios: Case studies and scenarios should reflect the real world authentic and complex environmental problems. While students are working on these cases and scenarios they have to apply their knowledge and abilities from various disciplines, hence they show whether they internalize the transdisciplinary of environmental problems or not (Herreid, 1998).

5. Performance Assessment: Real-world tasks are used to assess students' performance while they are participating in solutions of environmental issues and performing actions such as environmental advocacy, community engagement, or research. As a result, these performances indicate their commitment to sustainability (Airasian & Russell, 2008).

6. Reflective Essays and Journals: Reflective essays and journals are written by students throughout their TEE experience. They write about their insights, challenges they faced, thoughts about their own improvements and ethical issues. They can be useful in determining students' situation at the social and cultural dimensions and environmental problems (Moon, 2001).

7. Rubrics: Rubrics or predefined criteria enables students to comprehend requirements and their responsibility in their projects or products about environmental problems. Therefore, they provide reliability and validity in evaluation (Moskal, 2000).

These assessment methods are not the only possible ones, as environmental problems are transdisciplinary and multidimensional, so the students' understanding and comprehension about the environment. So as knowledge and insights from various stakeholders should be integrated in the solution of environmental problems, these assessment methods should be incorporated in line with the requirements of the instructional programs and learning outcomes of transdisciplinary environmental education.

#### Topics or content used in transdisciplinary environmental education

In order, individuals and, in particular, students, to comprehend the multi-dimensional and multi-agent nature of Transdisciplinary Environmental Education (TEE), the topics and contents should reflect these characteristics of TEE also. The following list encompasses various fields that TEE can be applied to but many more fields or topics can be added to the list. Since, the environmental issues that will occupy humankind in future cannot be predicted with high consistency.

Following fields of environmental science and education are just the beginning and as time passes formerly unpredicted topics are added to this list: Biodiversity conservation, ecosystem services, habitat loss, and the importance of biodiversity (Hooper et al., 2005); Climate science, mitigation, adaptation, renewable energy, sustainable development, and the Paris Agreement (IPCC, 2021); Ethics of environmental stewardship, environmental justice, indigenous perspectives, and ethical dilemmas in environmental decisionmaking (Rolston, 2012); Environmental regulations, international agreements, the role of government and NGOs, and environmental policy analysis (Jordan et al., 2010); Organic farming, food security, sustainable agriculture practices, and the farm-to-table movement (Pretty, 2018); Water quality, watershed management, freshwater ecosystems, and access to clean water (Gleick, 1993); Economic valuation of natural resources, the cost of environmental degradation, and market-based environmental policies (Pearce & Turner, 1990); Endangered species, wildlife conservation strategies, and human-wildlife conflicts (Soule & Orians, 2001); Effective communication strategies, environmental education methodologies, and the role of media in shaping public perceptions of environmental issues (Monroe, 2003); Sustainable urban planning, green infrastructure, urban biodiversity, and the ecological footprint of cities (Grimm et al., 2008); Indigenous perspectives on the environment, traditional ecological knowledge, and the cultural dimensions of environmental issues (Berkes, Colding, & Folke, 2000); Air and water pollution, toxic substances, public health implications, and environmental justice in relation to pollution (Landrigan et al., 2017); Ecosystem restoration, reforestation,

wetland restoration, and habitat rehabilitation (Suding et al., 2015); Population dynamics, resource depletion, overconsumption, and sustainable population growth (Ehrlich & Ehrlich, 2013); Geographic Information Systems (GIS), remote sensing, data collection and analysis, and the role of technology in environmental monitoring (Jensen & Cowen, 1999).

#### **Sample Project Ideas and Cases for TEE**

The first project sample is related to Water Education and is planned for preservice teachers as an elective course in universities. In this course, students are required to complete a project with two phases. Design-based thinking and project based learning are the primary instructional techniques. Briefly, 9-week project can be summarized as following:

In Turkey, it is foreseen that within 10 years, a significant decrease in water supplies would occur. A significant and long-term drought is expected. Therefore, immediate and emergent nation-wide measures should be taken. Since the measures would be nation-wide, all related parts of the problem (Government, industry, agriculture agents and also the society) should be awakened.

This project is designed as a two phase study. In the first phase of the project, the role of my students will be to decide on a target audience (housewives, kindergarten children, teachers, farmers, municipality stakeholders, and etc.) and then to design an instruction program for creating a water literacy and behavioral change in their audience. While going through their aim, they should use some AI tools. AI tools will help to reach people living in rural areas or in isolation and social distancing. Also, AI tools will be used in evaluating the effect of programs to improve water literacy.

The instructor will present the problem situation. In fact, water is a problematic issue all over the world. In Africa, a woman or a child has to walk about 4 hours a day to reach water. Unfortunately, most often this water is not sanitized appropriately causing water-related diseases. In India or in China, Taiwan, excess amounts of rain causes floods destroying lives, farming areas and water resources. Along with global warming and climate change, water related problems are becoming more and more serious. Instructor will present students, resources, reports about the problem, ask them to read and reflect about the issue from different perspectives (scientific, historical, geographical, gender inequalities, human rights, and values, etc.). They will work in groups of two to four and make a presentation about water issues from one of those perspectives.

In the second phase, Instructor will ask them to observe and search for a water related problem around the city where they are all living. They will search google, local and mainstream media, YouTube, etc., and will talk to informed individuals. They will propose a solution to the problem they chose.

## Environmental Education as a Transdisciplinary Process

At the end of the project, preservice teachers should be able;

- Design an instruction to improve water literacy of an intended audience.
- Locate appropriate and useful information
- Design a solution to a water related local problem

First Phase of the Project

First week:Empathize

In this step, students will decide on their groups and their target audience. They will design an instruction for this audience to become water literate. Firstly, they should know how their audiences behave in water related conditions, and what they think about water?

They will

- make an online survey using google forms,
- interview with a sample,
- review the previous studies and news, interviews.

At the end of this part, they would be informed about the characteristics and needs of the target audience.

Second week: Define (the problem or challenge) and Ideate

In the next step, students will

- clarify and articulate the problem,
- make conclusions about the information they would obtain in the previous

step.

They will create answers for the questions: "What are the current conditions?" "What needs to be changed?" "What needs to be preserved, to be developed, and etc?".

Before going through the next step, the problem will be stated clearly.

Then, they will propose instructional elements (time, duration, media, methods of instruction, methods of evaluation, etc.). They will not limit themselves here, they will list all the ideas and then judge them according to affordability, applicability, usefulness, effectiveness, attractiveness, and etc.

Third week: Prototype

At the end, they will decide on one agreed upon instruction and develop it. They will decide the aims and goals, assessment techniques, instructional media, duration of

the instruction, message channels on their own.

Fourth week: Test, Debrief and Reflect

After developing the instructional module for their target audience, they will administer this module to a sample of their audience. They will collect data about the effectiveness, efficiency, usefulness, user-friendliness of the module. They will decide on data collection instruments and how to evaluate the data.

In the last step of the circle, they will evaluate the feedback they obtained and reflect about the successful and unsuccessful parts of the module and about possible reasons for them. They will suggest necessary revisions for all of the previous steps.

## Second Phase of the Project

In the second phase, the instructor will ask them to observe and search for a water related problem around the city they are all living in. They will search google, local and mainstream media, YouTube, etc., and will talk to informed individuals. In fact, water pollution in River M., water and air pollution due to geothermal power plants, soil pollution due to water quality in farming areas, erosion are examples of water related problems in that city.

Fifth week:Empathize and Define (the problem or challenge)

They will search google, local and mainstream media, YouTube, and etc., will talk to informed individuals, for a water related problem around Aydın, in the city they are all living. They will have information about different viewpoints related to the problem they chose. So they can empathize about the thoughts and feelings of the people who are affected.

They will define their problems. They should make the problem situation clear. They should answer the "what, who or whom, where, when, why, and how" questions related to the research problem. In the end, they will write a concise research question.

## Sixth week: Ideate

After defining the problem, they brainstorm about the possible solutions. They will list all the ideas and then eliminate them one by one according to feasibility criteria. Is the proposed solution applicable, economic, scientifically appropriate, completed in given duration, and etc.?

Seventh and eighth weeks: Prototype & Test & Debrief and Reflect

They will design a solution after considering all possible ones. They will make a prototype of the solution and test it. According to results of the testing, they will propose revisions on either the prototype or the research question, or on both.
Ninth week: Present/Share

Students will present their research process and results of the two phases to other students in a science fair organized at the end of each semester in their faculty.

Materials and Resources:

UNESCO Institute for Water Education (UNESCO-IHE) - http://www.unesco-ihe.org/Education

National Geographic, "Water: A Special Issue" -

http://ngm.nationalgeographic.com/2010/04/table-of-contents

NASA Earth Observatory, "The Water Cycle" -

http://earthobservatory.nasa.gov/Features/Water/

Educating Young People About Water - http://www.uwex.edu/erc/eypaw/

Water Resources Education - http://clean-water.uwex.edu/

International Decade for Action "Water for Life" 2005-2015 -

http://www.un.org/waterforlifedecade/

World Water Council - http://www.worldwatercouncil.org/

World Water Assessment Programme - http://www.unesco.org/water/wwap/

UNESCO, (2012) Learning about water: multiple-perspective approaches. https://unesdoc.unesco.org/ark:/48223/pf0000215432

WWAP (UNESCO World Water Assessment Programme). 2019. The United Nations World Water Development Report 2019: Leaving No One Behind. Paris, UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000367306

Assessment:

Student journals: Students will note their daily reflections about the project process. There will not be any pre-specified topics, so mostly mentioned issues in project preparation will be determined.

Collaboration Rubric: Each student will fill this rubric to evaluate the collaboration they exhibit during the project. Also instructor will note his/her own observations for each group

Instruction Checklist: This checklist will be completed by the instructor to evaluate the instruction module for water literacy.

Solution Rubric: This checklist will be completed by the instructor to evaluate

the solution students create for a water-related local problem. Students will be aware of this rubric before they begin their project.

What criteria or assessment will be used to evaluate the effectiveness of the lesson or unit of study? At the end of the course students will be tested on their knowledge of water literacy, design thinking and research skills and information gathering. If students' performance was acceptable (more than %70 correct answers to the questions related to each topic), then this lesson would be evaluated as effective.

## Career Connections:

Before the phases of the project begin, a hydrologist (water scientist) will be invited to the class or invited to an online interview. Also, representatives of the WWF organization will be invited to talk about the current status of water resources in Turkey and throughout the world and about the water footprint. These interviews will provide students to reflect about water related STEM careers.

Also modeling and forecasting studies of future trends in water resources will be explained to students to inform them about the possible role of AI in water studies.

As a result, they, as prospective teachers, can guide their students about STEM careers in water related disciplines.

The second case is a real world scenario around which TEE can be built. It is a real case experienced in Van, one of the Eastern cities of Turkey, located on the shore of Lake Van, the biggest lake in Turkey. In that lake, an endemic fish species lives called Pearl Mussel. Lake Van has a carbonated and salty water, nevertheless, these fish need fresh water in order to spawn. Therefore, they swim across the flow of rivers, streams and they seem as if they are flying. In this period, catching them is very easy, so due to the excess amount of fishing, nearly the whole city smells like fish for nearly 2 months of a year. The problem is not only the odor, by catching these fishes, the eggs, in other words, the next generations, are also destroyed. This situation will cause the loss of the Pearl Mussels in the lake, and not sustainable for both fish and fishers and also for the local population.

In a project prepared according to TEE, this case will be presented to learners, then they are asked to define the problem and situation from the perspective of all related stakeholders, (governmental and nongovernmental organizations, fishers, lay-people, fish and ecosystem partners, tradesmen, and etc.). After picturing the situation; learners will foresee what would happen if something would not be done and also what should be done in order to sustain the existence of Pearl Mussels. They will maintain what the situation is and what it would be if the necessary measures are taken. They will brainstorm, propose all the solution ideas without thinking thoroughly. Next, they will choose the most feasible solutions in terms of time, money, effort and success, in this

step learners could decide these criteria also.

Following the selection of most feasible solutions, learners will perform and test these. This process is iterative, learners should reflect upon their solutions and make necessary corrections and test the corrected ones, and so on.

As the last phase of the project, they will prepare an improvement report and publish it in the media, sharing the results of their project with each stakeholder.

In fact, almost 2 years ago, I watched a TedX video on YouTube; Prof. Dr. Mustafa Sarı was giving a speech titled "Pearl Mussels never return back!". This video is about the challenges that he faced while he was trying to save Pearl Mussels, in fact, these challenges are with him and various governmental ministries, fishermen, villagers, universities, etc. Each time his friends and he found a way to overcome and moreover they learned new ways to communicate and handle the issues from a variety of perspectives. You can reach this video from the URL: <u>https://www.youtube.com/watch?v=9H\_YsX9d2X0</u> (retrieved from YouTube on 22.10.2024). Such real world, true-life cases can be found from documentaries, journals, podcasts, newspapers, and etc. You can transform them to use in your TEE lessons.

#### **Challenges and Future Directions**

TEE provides a holistic, integrated, inclusive, multi-disciplinary, multi-perspective, transformative approach to both environmental science and environmental education, however, TEE also faces severe challenges. Resource constraints, resistance to change in educational systems, and the need for ongoing professional development for educators can be put forward as some of these challenges. Nevertheless, since the trandisciplinarity of the environmental issues must be considered in order to address current and future environmental problems, TEE constitutes a proper way to educate eco-literate, environmentally aware generations of the future (Jones, 2021)

In conclusion, transdisciplinary environmental education is a transformative approach that empowers students to become informed, engaged, and proactive stewards of the environment. By breaking down the walls between academic disciplines, fostering collaboration, and emphasizing sustainability, TEE equips students with the tools and mindset needed to create a more sustainable future. This chapter has provided an overview of TEE's principles, implementation strategies, benefits, and challenges, highlighting its importance in shaping environmentally conscious citizens and leaders.

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# CHAPTER 6

# Is Climate Change the Most Important Environmental Problem? The Relationship between Environmental Problems and Climate Change

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## Climate

Climate refers to the long-term patterns and averages of weather conditions in a particular region or on Earth as a whole. It encompasses a wide range of atmospheric parameters, including temperature, humidity, precipitation, wind patterns, and more. Climate is distinct from weather, which refers to the short-term atmospheric conditions that can change daily or even hourly (Cartwright et al., 2021).

Climate is influenced by a variety of factors, including latitude, altitude, proximity to oceans or large bodies of water, and prevailing wind patterns. Climate can also change over long periods due to natural factors such as volcanic activity and variations in Earth's orbit, as well as human activities like deforestation and the release of greenhouse gases, which are contributing to modern climate change (Betz, 2019).

Understanding the climate of a particular region is crucial for agriculture, urban planning, and environmental management, as it helps predict long-term weather patterns and informs decision-making related to issues such as water resource management, disaster preparedness, and conservation efforts (Crisman et al., 2023).

## **Climate Change**

Climate change refers to significant and long-term alterations in the Earth's climate

patterns, particularly changes in temperature and weather conditions, which are primarily driven by human activities. While the Earth's climate has naturally varied throughout its history, the term "climate change" is commonly used today to refer to the rapid and unprecedented changes in the Earth's climate system that have occurred since the Industrial Revolution, which began in the late 18th century (Baede et al., 2001).

The primary driver of contemporary climate change is the increase in greenhouse gas concentrations in the Earth's atmosphere, primarily carbon dioxide (CO<sub>2</sub>), methane  $(CH_{\lambda})$ , and nitrous oxide  $(N_{\lambda}O)$ . These gases are released into the atmosphere through activities such as the burning of fossil fuels (coal, oil, and natural gas), deforestation, and various industrial processes. Greenhouse gases trap heat from the sun, leading to a gradual warming of the planet, a phenomenon often referred to as global warming (Shukla et al., 2019).

Climate change is not only caused by human activities but also by natural events. There are several natural events that can cause climate change. Volcanic activities, solar radiations, orbital variations and El Niño and La Niña are the main examples of natural events that cause climate change. The release of gases that cause climate change significantly increases climate change. For this reason, the effect of gases released during volcanic activities on climate change has been the subject of research in many studies. When a volcano erupts, it releases a significant amount of greenhouse gases, such as carbon dioxide and sulfur dioxide, into the atmosphere. These gases can have a short-term cooling effect but can also contribute to long-term warming. Variations in the sun's energy output can influence Earth's climate. Changes in solar radiation affect the intensity and distribution of heat on our planet. The warming of the planet due to an increase in solar irradiance probably results in the release of methane and carbon dioxide from stores in the oceans and icecaps, and these greenhouse gases can then produce additional warming (National Academy of Sciences, 2020). Another natural phenomenon that causes climate change orbital variations. Earth's orbit around the sun experiences cyclic variations over long periods of time. These variations, known as Milankovitch cycles, can alter the amount and distribution of sunlight reaching Earth, impacting global climate patterns. Unexpected changes in the currents in our oceans, which maintain the natural balance that allows the world to warm and cool, affect climate change (Curran et al., 2021). El Niño and La Niña: El Niño and La Niña are natural climate phenomena that occur in the Pacific Ocean. These events involve the warming (El Niño) or cooling (La Niña) of the ocean surface, leading to changes in global weather patterns. It's important to note that while natural events contribute to climate change, human activities, such as burning fossil fuels and deforestation, are the primary drivers of the current climate crisis.

Climate change has many negative effects on the environment and living things.

Rising global temperatures are the most important of these effects. Due to the change of climate, the average global temperature has been steadily increasing, leading to warmer temperatures on Earth. This warming is linked to more frequent and severe heatwaves. These rising temperatures cause melting ice and rising sea levels. Higher temperatures are causing glaciers and polar ice caps to melt, contributing to rising sea levels. This poses a threat to coastal communities and ecosystems (IPCC, 2021). Climate change causes not only warming of the air but also changes in precipitation patterns. Climate change can lead to altered rainfall patterns, with some areas experiencing more intense rainfall and flooding, while others may face drought conditions (Cheng et al., 2016). In addition, climate change is associated with an increase in the frequency and intensity of extreme weather events, such as hurricanes, typhoons, wildfires, and heavy storms. In addition, climate change has caused not only the amount of CO<sub>2</sub> in the air to increase, but also the amount of  $\text{CO}_2$  in ocean waters. Increased  $\text{CO}_2$  levels are absorbed by the oceans, leading to ocean acidification, which can harm marine life, including coral reefs and shellfish (Findlay & Turley, 2021). Such rapid changes in the air and oceans do not allow living things to adapt and survive. That's why most ecosystems are disrupted as a result of climate change induced adverse conditions. Many species are struggling to adapt to rapidly changing conditions, which can lead to shifts in ecosystems and threaten biodiversity. One of the negative consequences of climate change is the adverse impact on agriculture and food security (Kumar et al., 2018). Changes in temperature and precipitation patterns can affect crop yields and food production, potentially leading to food shortages in some regions. While our world is struggling with famine and epidemics in many places, our world is becoming more fragile due to the impact of climate change. Extreme weather conditions caused by climate change pose human health risks for people same as all living things. Heatwaves, vector-borne diseases, and air pollution associated with climate change can pose health risks to human populations.

Efforts to address climate change involve reducing greenhouse gas emissions through measures such as transitioning to renewable energy sources, improving energy efficiency, protecting and restoring forests, and adopting sustainable land-use practices. International agreements like the Paris Agreement aim to bring countries together to set emission reduction targets and limit global temperature increases to well below 2 degrees Celsius above pre-industrial levels, with efforts to limit the increase to 1.5 degrees Celsius. These actions are essential to mitigate the worst impacts of climate change and protect the planet for future generations.

#### **Factors Causing Climate Change**

Climate change is primarily driven by human activities and natural processes. There are many human activities that cause climate change. The most well-known and visible human activities that cause climate change are greenhouse gas emissions, deforestation, agriculture, industrial processes, transportation, land use changes, unsustainable energy

use. The primary driver of contemporary climate change is the release of greenhouse gases into the atmosphere. Human activities, such as the burning of fossil fuels (coal, oil, and natural gas) for energy, deforestation, and industrial processes, have significantly increased the concentrations of greenhouse gases, including carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) in the atmosphere (USEPA, 2016). These gases trap heat from the sun, leading to a warming effect known as the enhanced greenhouse effect. Many human activities unconsciously increase greenhouse gas emissions and cause climate change. For example, cutting down forests and clearing land for agriculture and development reduces the Earth's capacity to absorb CO<sub>2</sub> through a process known as carbon sequestration. Deforestation is not only an environmental problem but also a one of the important causes of climate change. Forests act as carbon sinks, removing CO<sub>2</sub> from the atmosphere and storing it in trees and soil. Deforestation, therefore, contributes to higher atmospheric CO<sub>2</sub> levels (Bala et al., 2007). Another cause of human induced climate change is the agriculture practices. Agricultural practices, particularly livestock farming and rice cultivation, produce methane, a potent greenhouse gas. Additionally, the use of synthetic fertilizers in agriculture releases nitrous oxide, another potent greenhouse gas (Ortiz-Bobea, Ault, Carrillo, Chambers & Lobell, 2021). Changes in land use for agriculture can also lead to habitat loss and biodiversity decline, further affecting ecosystems and the climate. In addition to agriculture practices, various industrial processes, such as the production of cement and the use of certain chemicals, release greenhouse gases as byproducts. These emissions contribute to the overall greenhouse effect. Similarly, the transportation sector, including cars, trucks, ships, and airplanes, is a significant source of greenhouse gas emissions, primarily from the burning of fossil fuels for propulsion. In addition to the factors that have a global impact on climate change, there are also human induced factors that have a regional impact. Urbanization, land use changes, and the expansion of agriculture also contribute to local and regional climate changes, known as urban heat islands and land-use effects. Urbanization and land development alter land surfaces, affecting local climates and contributing to the

Climate change is also influenced by natural factors, such as volcanic eruptions, which can release large amounts of volcanic aerosols into the atmosphere, temporarily cooling the planet. Additionally, variations in solar radiation and natural climate cycles, like El Niño and La Niña, can influence short-term climate patterns. Climate change can trigger feedback loops that amplify its effects. For example, as the Arctic ice melts due to warming temperatures, it reduces the Earth>s albedo (reflectivity), leading to more heat absorption and further warming. Similarly, thawing permafrost releases methane, a potent greenhouse gas, into the atmosphere.

urban heat island effect, where cities are significantly warmer than their surrounding

rural areas (Li et al., 2022).

It's important to note that while natural factors and processes can influence

climate, the current rate and extent of global warming are primarily attributed to human activities. Addressing climate change involves reducing greenhouse gas emissions, transitioning to cleaner energy sources, conserving forests, and implementing sustainable land-use practices to mitigate its impacts.

#### Is Climate Change a Major Environmental Problem?

Many people see climate change as the most important environmental problem for several reasons. It is very difficult to list these reasons in items. However, we can list a few of the most important reasons. Global impact on all regions, urgency due to rapid rate of change, interconnectedness with other environmental problems and critical concerns, magnitude of impact, long-term consequences, scientific consensus, global agreements, media coverage, youth and activism, economic implications are some of the important reasons to see climate change as an important environmental problem (Skogen et al., 2018).

Climate change is a global issue that affects all countries and regions. It doesn't respect national borders, and its impacts are widespread and interconnected. Rising global temperatures, sea-level rise, extreme weather events, and changing precipitation patterns can have far-reaching consequences, making it a top priority for international cooperation. Interplay of climate change-exacerbated rainfall, exposure and vulnerability led to widespread impacts in the Mediterranean region (Zachariah et al., 2023). The latest painful example of global impact of climate change is the flood disaster in Libya. According to the report published by the international "World Weather Attribution" initiative, human-induced climate change has made floods 50 times more likely in Libya. The severe flood disaster that occurred in Spain, Greece, Turkey, Bulgaria and Libya was caused by very heavy rains falling in less than 24 hours in Spain, while it lasted 24 hours in Libya and 4 days in Greece and Turkey. The incident in Libya The magnitude is well beyond that of previously recorded events, and we conclude that for the broad region that includes Greece and parts of Bulgaria and Turkey, human-caused climate change is making these events up to 10 times more likely and up to 40 percent more severe. The change made flooding in Libya up to 50 times more likely and up to 50 percent more severe. Even in this last striking example, many Mediterranean countries were affected (Christidis et al., 2023). Climate change is a common problem not only for a country or the people living in a region, but for the whole world.

Climate change is often perceived as an urgent problem because of the rapid rate of change and its potential to cause irreversible damage to the planet. The longer we delay taking action, the more challenging and costly it becomes to mitigate its effects. Climate change causes average temperatures to rise around the world. This leads to events such as drought, depletion of water resources, fires and extreme heat. Such events pose serious threats to agriculture, water resources, food security and human health. If precautions are not taken, we may encounter irreversible, unexpected consequences in the near future. As sea levels rise due to melting glaciers, it can seriously affect coastal areas and island countries and lead to the displacement of millions of people. Climate change is a long-term problem that will affect future generations. Precautions not taken today may leave future generations with a more difficult and costly problem (Miles-Novelo & Anderson, 2022).

Climate change is not just an environmental issue; it intersects with various other critical concerns, including public health, food security, water resources, and economic stability. These interconnected challenges amplify the urgency of addressing climate change. Climate change affects natural ecosystems, alters the habitats of plant and animal species, and increases the risk of extinction of some species. This can lead to loss of biodiversity and disruption of food chains. Climate change affects not only the plants and animals living in the natural ecosystem but also the people in that system (Islam & Kieu, 2020). As a result of the degradation of the ecosystem, resources that are critical for human life are also affected. In addition, climate change can affect key sectors such as food production, water resources, energy supply and healthcare. This can disrupt economic stability and social balances, posing a greater threat especially to more vulnerable societies. Besides, climate change increases the frequency and severity of extreme weather events. These include events such as hurricanes, floods, droughts, and extreme rainfall. Such events can cause loss of life and billions of dollars in damage. Focusing only on the known effects of climate change, such as global warming, sea level rise, and extreme weather conditions, does not cover all the effects of climate change. In fact, climate change changes the entire ecosystem of the world and therefore interconnectedness with other environmental problems and has global impact on the world (Cramer et al., 2018).

Climate change has long-term consequences that affect future generations. People are concerned about the kind of world their children and grandchildren will inherit, making it a deeply personal and moral issue for many. In the long term, it may increase the frequency and severity of extreme heat waves. This can lead to consequences such as drought, reduced water resources and reduced agricultural productivity. Irreversible rises in sea level may cause the disappearance of some coastal areas and islands. Destruction of natural ecosystems can lead to the extinction of some species and result in loss of biodiversity. In the long term, these changes in ecosystems can affect people's access to food sources, water resources, and other ecosystem services. When agriculture and food security are affected, it can lead to increased food prices and deepening food insecurity problems in the long run. Considering the social and economic effects of climate change on societies, its long-term effects pose significant risks (Skogen et al., 2018).

There is a strong consensus among climate scientists that climate change is



primarily driven by human activities, particularly the emission of greenhouse gases. This scientific consensus lends credibility to the severity of the issue (Miles-Novelo & Anderson, 2022). Moreover, international agreements, such as the Paris Agreement, highlight the recognition of climate change as a paramount global challenge. The commitment of numerous countries to reduce greenhouse gas emissions underscores its importance on the international stage. Also, the economic consequences of climate change, including damage to infrastructure, agriculture, and insurance costs, have garnered attention from business leaders and policymakers. Climate change is increasingly seen as a financial risk that needs to be managed. Furthermore, climate change often receives significant media attention, raising public awareness and concern. Events like extreme weather disasters, melting glaciers, and rising sea levels are frequently covered in the news, helping to keep the issue in the public eye (Cramer et al., 2018). In addition to scientific consensus, international agreements and media coverage, young activists and movements like Fridays for Future, led by figures like Greta Thunberg, have brought climate change to the forefront of public consciousness. Young people around the world are advocating for immediate climate action, influencing public perception and policy discussions. Studies addressing the results of the Paris Agreement, which has obvious global importance, and awareness of people about environmental projects in the context of environmental education are important steps for climate change (Erten & Atmaca, 2021; Köseoğlu & Erten, 2022).

While climate change is seen as the most important environmental problem by many, it's important to note that other environmental issues, such as habitat loss, biodiversity loss, air and water pollution, and plastic pollution, also pose significant challenges and are interconnected with climate change. Addressing these issues collectively is crucial for ensuring a sustainable and healthy planet.

**The Relationship between Climate Change and Other Environmental Problems** Addressing climate change often requires tackling the root causes of other environmental problems, and addressing these issues can, in turn, help mitigate climate change impacts. Integrated and holistic approaches are crucial to finding solutions that effectively address the interconnected challenges posed by these environmental problems. Climate change

is intricately connected to various other environmental problems, and these relationships can exacerbate the challenges humanity faces in addressing both climate change and these associated issues (Cramer et al., 2018). Other environmental problems closely associated with climate change are biodiversity loss, water scarcity, land degradation, air pollution, ocean acidification, deforestation, migration and energy use.

Climate change can lead to shifts in habitats and temperature regimes that affect ecosystems and species. Biodiversity loss, in turn, reduces the resilience of ecosystems to climate impacts and disrupts essential ecological processes (Shukla et al., 2019). In addition, changes in precipitation patterns and increased evaporation due to higher temperatures can lead to water scarcity. Water scarcity, coupled with climate variability, can strain water resources for both human consumption and agricultural use (Gude, 2017). Also, rising temperatures, altered rainfall patterns, and increased frequency of extreme weather events can contribute to land degradation, including soil erosion, desertification, and loss of fertile land. Moreover, some activities that contribute to climate change, such as burning fossil fuels, also release air pollutants. These pollutants can degrade air quality and have adverse health effects on humans and ecosystems. Similarly, the absorption of excess atmospheric carbon dioxide by the oceans leads to ocean acidification, which harms marine ecosystems, particularly coral reefs and shellfish populations. As a solution, forests act as carbon sinks, absorbing atmospheric carbon dioxide. Deforestation contributes to carbon emissions and reduces the planet's capacity to mitigate climate change. Furthermore, the need for increased cooling and heating due to temperature changes can affect energy demand. Energy production itself contributes to greenhouse gas emissions, creating a feedback loop between energy use and climate change (USEPA, 2016). Consequently, climate-related environmental changes can contribute to migration patterns and, in some cases, exacerbate tensions over resource scarcity, potentially leading to conflict. These issues regarding climate change are discussed in more detail below.

#### **Biodiversity Loss**

The relationship between climate change and biodiversity loss is complex and intertwined. Climate change directly impacts biodiversity by altering ecosystems, habitats, and species distributions, and at the same time, biodiversity loss can contribute to climate change by disrupting ecosystems' ability to regulate carbon and other environmental processes.

Climate change affects temperature and precipitation patterns, leading to shifts in habitats and ecosystems. Species that are adapted to specific climatic conditions may struggle to survive in altered environments, leading to reduced populations or even local extinctions (Höök et al., 2020). Moreover, many species are already migrating towards higher altitudes or latitudes to find suitable climate conditions. However, if their migration ability is limited or if they encounter barriers, they may not find appropriate habitats, leading to reduced population sizes or declines due to climate change (Weiskopf et al., 2020). Species with small populations or specialized habitat requirements are particularly vulnerable to climate change. Those that cannot adapt quickly enough or find new suitable habitats are at a higher risk of extinction (Trew & Maclean, 2021). Biodiverse ecosystems provide essential services like pollination, soil fertility, and water purification. As biodiversity declines due to climate change, these services may become less reliable or even collapse, impacting human well-being (Nunez et al., 2019). Particularly, climate change will lead to a decrease in the pollination activities of bees. The decrease in pollination activities, which is extremely important for plant



productivity, will bring about plant productivity losses (Eştürk, 2022). Regarding this situation, in a study on the pollination activity of bees due to climate change, Rader et al. (2013) studied watermelon and estimated that bees would cause a 14% decrease in watermelon yield by 2099 through the decrease in bee pollination due to climate change. On land, higher temperatures have forced animals and plants to move to higher elevations or higher latitudes, many moving towards the Earth's poles, with far-reaching consequences for ecosystems. The risk of species extinction increases with every degree of warming (United Nations, 2023).

## Figure 1.

Climate Change (United Nations, 2023)



Intact ecosystems, such as forests and wetlands, play a vital role in absorbing and storing carbon dioxide. Biodiversity loss, especially in these ecosystems, reduces their capacity to sequester carbon, contributing to climate change (Miles, 2022). Also, biodiversity loss can amplify climate change through positive feedback loops. For example, the thawing of permafrost in the Arctic releases stored carbon and methane, contributing to greenhouse gas emissions and further warming (Mattox & Duda, 2022). Rising sea temperatures and ocean acidification caused by climate change can harm marine ecosystems, including coral reefs, which are among the most biodiverse habitats on Earth (Kelley et al., 2015). Addressing both climate change and biodiversity loss requires integrated strategies. Conservation efforts that protect and restore ecosystems can enhance their resilience to climate impacts (Malhi et al., 2020). Simultaneously, addressing climate change can help preserve biodiversity by reducing the pressures on ecosystems. Recognizing these interconnected challenges and implementing coordinated solutions is crucial for a sustainable and resilient future.

## Water Scarcity

The relationship between climate change and water scarcity is significant and multifaceted. Climate change impacts the water cycle by altering precipitation patterns, increasing evaporation rates, and causing more frequent and severe extreme weather events. These changes exacerbate existing water scarcity challenges and create new ones.

Climate change can lead to shifts in rainfall patterns, causing some regions to experience more intense and prolonged droughts while others face heavier rainfall and increased flood risks (Fischer & Knutti, 2015). Altered precipitation patterns can lead to reduced recharge of groundwater reserves, depleting an important source of water in many regions (Scibek & Allen, 2006). As a result, increased demand for water due to population growth and economic development, combined with reduced water availability, intensifies competition for limited water resources. One of the important needs about water is sanitation and hygiene. Climate change induced water scarcity can lead to poor sanitation and hygiene practices, increasing the risk of waterborne diseases and impacting human health (Gude, 2017). Another effect of climate change is agriculture because of major water consumer. Changes in precipitation patterns and increased temperatures can affect crop yields and irrigation needs, leading to increased pressure on water resources. Moreover, higher temperatures caused by climate change result in increased evaporation rates from surface water bodies and soil, reducing water availability for ecosystems and human consumption (Trenberth, 2011). In addition to impact on precipitation and evaporation patterns, rising temperatures cause glaciers and snowpack in mountainous regions to melt at an accelerated rate (Mattox & Duda, 2022). Furthermore, rising sea levels can lead to saltwater intrusion into freshwater aquifers in coastal areas, rendering these sources unfit for human consumption and agricultural use (Figure 2).

#### Figure 2.

Soil land and Water (Food and Agriculture Organization of the United Nations, 2017)



More frequent and severe droughts, storms, and floods due to climate change can damage water infrastructure, disrupt supply systems, and contaminate water sources, worsening water scarcity. In regions where water scarcity is already a concern, climate change can exacerbate resource competition, leading to migration and even conflict over water resources (Scibek & Allen, 2006). Problems arising from climate change affect not only humans but all living things and the ecological balance in their ecosystem are disrupted. Climate change induced reduced water availability affects freshwater ecosystems, leading to habitat loss and reduced biodiversity (Malhi et al., 2020). Aquatic ecosystems like rivers, lakes, and wetlands are particularly vulnerable.

Addressing water scarcity in the context of climate change requires adaptive strategies that consider the changing hydrological conditions. These may include improving water-use efficiency, investing in water storage and management infrastructure, implementing sustainable agricultural practices, and fostering international cooperation for equitable water sharing. Integrated approaches that consider both climate change and water resource management are essential to ensure water availability and resilience in the face of changing climate conditions.

#### Land Degradation

The relationship between climate change and land degradation is intertwined and mutually reinforcing. Climate change exacerbates land degradation processes, while land degradation contributes to climate change by releasing stored carbon and reducing the land's ability to sequester carbon. Some of the important relationships between climate change and land degradation are extreme weather events, soil erosion, loss of vegetation cover, desertification, deforestation, vulnerable communities, respectively (Shukla at al., 2019). Firstly, climate change leads to more frequent and intense extreme weather events such as heavy rainfall, droughts, and storms. These events can trigger erosion, soil compaction, and loss of soil structure, accelerating land degradation. Secondly, climate change can alter precipitation patterns and temperature regimes, leading to reduced vegetation cover. Vegetation plays a critical role in preventing soil erosion by stabilizing the soil with its root systems. Then, altered precipitation patterns and increased intensity of rainfall events due to climate change contribute to soil erosion, which is a form of land degradation. Eroded soil can carry nutrients away from agricultural fields and pollute water bodies. Also, higher temperatures and changes in precipitation patterns can exacerbate desertification processes, converting productive land into arid or semi-arid areas with reduced vegetation cover and soil fertility (Shukla et al., 2019). Especially, forests act as carbon sinks, absorbing carbon dioxide from the atmosphere. Deforestation contributes to carbon emissions and reduces the land's capacity to sequester carbon, thus exacerbating climate change. In addition, land degradation releases carbon stored in soil and vegetation, contributing to greenhouse gas emissions. This is particularly relevant in peatlands, wetlands, and degraded forests (Figure 3).

## Figure 3.





Another important point where climate change and land degradation are related and trigger each other is the degradation of the ecosystem and therefore the vulnerable communities. Land degradation can contribute to positive feedback loops that worsen climate change. For example, degraded soils have reduced water-holding capacity, leading to reduced vegetation growth and further carbon loss (Skogen et al., 2018). Additionally, climate change can affect crop yields due to altered precipitation patterns and temperature extremes, which can contribute to overuse and degradation of agricultural land as farmers attempt to increase production. Significantly, land degradation reduces the ability of ecosystems to provide essential services such as water purification, soil fertility, and habitat for biodiversity, impacting human well-being (Shukla et al., 2019). One of the important consequences of climate change and land degradation is vulnerable communities. Many communities, especially in developing countries, are heavily dependent on natural resources for their livelihoods. Land degradation, worsened by climate change, can lead to reduced agricultural productivity and increased vulnerability.

Addressing both climate change and land degradation requires integrated strategies. Sustainable land management practices can improve soil health, increase vegetation cover, and enhance the land's capacity to sequester carbon (Skogen et al., 2018). These practices contribute to both climate change mitigation and adaptation efforts. Similarly, global climate mitigation efforts can indirectly help combat land degradation by reducing the factors that exacerbate it, such as deforestation and carbon emissions.

#### **Air Pollution**

The relationship between climate change and air pollution is interconnected and complex. While they are distinct issues, they are closely related as certain sources of air pollutants



also emit greenhouse gases that contribute to climate change. Additionally, some climate change mitigation efforts can have co-benefits for reducing air pollution. Essentially, many activities that release air pollutants, such as burning fossil fuels for energy and transportation, also emit greenhouse gases like carbon dioxide  $(CO_2)$  and methane  $(CH_4)$ . This means that some sources of air pollution are also sources of climate-warming gases. Additionally, some air pollutants, like black carbon (a type of particulate matter) and certain aerosols, have both warming and cooling effects on the climate. They can absorb sunlight and heat the atmosphere while also influencing cloud formation and reflectivity. Another interconnection is health impact. Air pollution can have severe health impacts, including respiratory and cardiovascular diseases (Demirbaş & Aydin, 2020). Climate change, by increasing temperatures and altering weather patterns, can worsen air quality and health risks (Figure 4).

## Figure 4.



Air pollution and climate change (Environmental Health Coalition, 2022)

Burning fossil fuels for energy is a major source of both air pollutants (like sulfur dioxide, nitrogen oxides, and particulate matter) and greenhouse gas emissions. In order to overcome climate change caused by burning fossil fuels, transitioning to renewable energy sources, such as solar and wind power, can help reduce both greenhouse gas emissions and air pollutants associated with fossil fuel combustion (Tang & Solangi, 2023). In addition, technologies that capture carbon dioxide from industrial processes or power plants can mitigate both climate change and the release of pollutants.

Climate change can increase the frequency and severity of wildfires, releasing large amounts of particulate matter and carbon dioxide. These fires contribute to air pollution and further amplify climate change. Efforts to address climate change, such as transitioning to cleaner energy sources, improving energy efficiency, and promoting sustainable transportation, can have co-benefits for air quality by reducing emissions of both greenhouse gases and harmful pollutants (Tang & Solangi, 2023). Simultaneously, addressing air pollution through cleaner technologies and regulations can contribute to

#### **Ocean Acidification**

climate change mitigation and improve public health.

The relationship between climate change and ocean acidification is closely linked through the absorption of excess carbon dioxide  $(CO_2)$  by the world's oceans. Carbon dioxide emissions not only contribute to global warming but also lead to a process known as ocean acidification.

The oceans act as a carbon sink, absorbing about one-third of the CO<sub>2</sub> emitted by human activities, primarily through the burning of fossil fuels. This absorption helps mitigate climate change by reducing the amount of CO<sub>2</sub> in the atmosphere. When CO2 dissolves in seawater, it reacts with water to form carbonic acid. This process lowers the pH of seawater, making it more acidic. This increase in acidity is known as ocean acidification. Hence, ocean acidification can create a feedback loop with climate change. Impacts on marine ecosystems can affect their ability to sequester carbon and thus influence the global carbon cycle (Allen et al., 2014). Moreover, ocean acidification has negative impacts on marine ecosystems, particularly on organisms that rely on calcium carbonate to build shells and skeletons, such as coral reefs, mollusks, and certain types of plankton. Especially, corals are highly sensitive to changes in pH, and ocean acidification can impede their ability to build and maintain their calcium carbonate structures (Findlay & Turley, 2021). This weakens coral reefs and threatens the biodiversity they support. In addition, ocean acidification affects the availability of calcium carbonate minerals that shellfish, like oysters, mussels, and clams, need to build and maintain their shells (Kelley et al., 2015). This can impact shell growth and overall health. Consequently, changes in the survival and growth rates of key species due to ocean acidification can disrupt marine food webs and ecosystems, affecting fisheries and marine biodiversity (Figure 5).



## Figure 5.

Ocean acidification (Pörtner et al., 2019)



Addressing both climate change and ocean acidification requires coordinated efforts. Reducing carbon emissions is crucial for mitigating both issues. Additionally, measures to protect marine ecosystems, such as creating marine protected areas and implementing sustainable fishing practices, can enhance the resilience of marine life to the impacts of ocean acidification (Curran et al., 2021). Recognizing the interconnections between these challenges is essential for developing comprehensive and effective solutions.

## Deforestation

The relationship between climate change and deforestation is closely intertwined, as both issues influence and reinforce each other. Hence, deforestation, the clearing of forests for various purposes, contributes to climate change by releasing stored carbon into the atmosphere, while climate change can impact forests through changing temperature and precipitation patterns. Therefore, forests are important carbon sinks, meaning they absorb and store carbon dioxide from the atmosphere. When forests are cleared or burned, the stored carbon is released back into the air as carbon dioxide, a major greenhouse gas that contributes to climate change. Particularly, deforestation reduces the Earth's capacity to sequester carbon (Figure 6). As forests shrink, their ability to remove carbon dioxide from the atmosphere diminishes, exacerbating the problem of elevated atmospheric carbon levels (Bala et al., 2007).

#### Figure 6.

Deforestation (Busch & Seymour, 2014)



Climate change can affect forests through altered temperature and precipitation patterns, which may lead to increased vulnerability to pests, diseases, and wildfires. These impacts can further degrade forests, releasing more carbon and contributing to climate change. Especially, some regions, such as the Amazon rainforest, have a hydrological cycle that depends on forests. Deforestation can disrupt this cycle, creating drier conditions that further promote forest degradation and fires. For this reasons, preserving and restoring forests can play a crucial role in mitigating climate change. Forest conservation and reforestation efforts can help absorb carbon dioxide from the atmosphere and enhance carbon storage. Also, indigenous and local communities often depend on forests for their livelihoods. Climate change impacts and deforestation can exacerbate vulnerabilities in these communities (Skogen et al., 2018). Addressing deforestation is an important component of global efforts to mitigate climate change. Efforts to conserve forests, promote sustainable land-use practices, and implement reforestation and afforestation projects can help both reduce carbon emissions and enhance the resilience of ecosystems to changing climatic conditions.

#### **Energy Use**

The relationship between climate change and energy use is central to understanding the root causes of climate change and the potential solutions to mitigate its impacts. Energy production and consumption are major contributors to greenhouse gas emissions, the primary drivers of climate change. In addition, the burning of fossil fuels, such as coal, oil, and natural gas, for energy is a major source of carbon dioxide (CO<sub>2</sub>) and other greenhouse gas emissions (Miles, 2022). Therefore, these emissions trap heat in the atmosphere and contribute to global warming. For instance, many power plants use



fossil fuels to generate electricity. Transitioning from these carbon-intensive sources to renewable energy sources, such as solar, wind, hydroelectric, and nuclear power, is critical to reducing emissions. Fossil fuels are also the primary energy source for transportation, including cars, trucks, ships, and airplanes. Shifting to electric vehicles and sustainable fuels can significantly reduce emissions from the transportation sector. Furthermore, industries like manufacturing and cement production rely on energy-intensive processes that release significant amounts of CO2. Implementing energy-efficient technologies and using low-carbon energy sources can help mitigate emissions. Additionally, shifting to renewable energy sources not only reduces emissions but also decreases the reliance on finite fossil fuel reserves, enhances energy security, and creates new economic opportunities (Tang & Solangi, 2023).

## Figure 7.



Transition to renewable energy sources (Jacobson, 2019)

Climate change can influence energy use by increasing the demand for cooling in hotter regions and heating in colder regions. Increased energy demand, often met by burning fossil fuels, can then contribute to more emissions and exacerbate climate change. Therefore, renewable energy can provide a sustainable solution for energy access without increasing emissions (Bala et al., 2007). As the global population grows, ensuring access to clean and affordable energy is essential. Also, addressing energy-related emissions requires international cooperation to share technologies, best practices, and policies for transitioning to cleaner energy sources. Efforts to combat climate change require a fundamental transformation of the global energy system (Figure 7). Transitioning away from fossil fuels, improving energy efficiency, and adopting sustainable energy sources are critical components of mitigating climate change and achieving a more sustainable future.

#### **Migration and Conflict**

The relationship between climate change, migration, and conflict is complex and can have wide-ranging social, economic, and political implications. While climate change is not the sole cause of migration and conflict, it can exacerbate existing vulnerabilities and tensions in regions already facing social and political challenges. In fact, those who migrate due to climate change cause more climate change by uncontrolled use of the resources in the regions they migrate to. Therefore, climate change can lead to resource scarcity, such as water and arable land, which can intensify competition among communities. This competition can lead to conflicts over access to limited resources. Especially, environmental changes, such as sea-level rise, droughts, and desertification, can displace communities that rely heavily on agriculture, fishing, or other climatesensitive livelihoods. This displacement can contribute to both internal and crossborder migration (House, 2007). As a result of climate-related events, such as extreme weather events, can damage infrastructure, disrupt supply chains, and negatively impact economies. These economic shocks can contribute to increased poverty and inequality, which are often associated with migration and conflict risks. Not only economical but also political instability negatively impact of climate change influence all world (Figure 8). Especially, climate change impacts can undermine the ability of governments to provide essential services and protect their populations. This can erode trust in institutions and potentially lead to political instability and conflicts (Nordås & Gleditsch, 2014).

#### Figure 8.

Mitigation and Climate Change (Migration Research Foundation Report, 2022)



Climate change-induced environmental stresses can lead to the displacement of people within their own countries or across borders. These displaced populations, known as climate refugees, can strain host communities and create tensions (House, 2007). As a result, some individuals and communities may choose migration as an adaptive response to environmental changes. This movement can lead to the potential for social tensions in host communities. Moreover, climate change-related stresses can amplify existing social and political tensions, creating conditions conducive to conflict escalation. Besides, climate change can exacerbate existing humanitarian crises by increasing the frequency and severity of natural disasters, which require responses from both local and international actors (Bettini, 2017). Consequently, recognizing and addressing the interactions between climate change, migration, and conflict requires a comprehensive approach. This includes efforts to reduce greenhouse gas emissions, strengthen local adaptive capacities, support sustainable development, enhance conflict prevention strategies, and promote international cooperation to address the root causes of vulnerability and instability.

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# **Environmental Issues, Their Solutions, and Sustainable Development Goals**

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## **Environmental Issues**

To be able to understand environmental issues, we first need to examine the concept of environment. Only in a healthy environment can a living organism continue to live healthily. According to the definition published by the Ministry of Environment and Forestry in 2008, the environment is the physical, biological, social, economic, and cultural setting in which living things meet their needs, maintain their relationships, and interact with each other throughout their lives. The environment, in short, is a system of relationships. Any disruption of this relationship upsets the natural balance. According to Erten's definition in 2004, the environment is the domain in which living and non-living elements interact with each other in equilibrium. Disruption of this balance between living and non-living elements by human behavior creates environmental issues.

Environmental issues and human problems are inextricably linked today. Examination of the causes and consequences of environmental issues reveals that man is not only the creator of these problems but also the most affected by them, and the only source of their solution. Environmental issues are global issues, and the whole world is striving to find a solution. They adversely affect everyone's lives regardless of age, sex and gender, or differences in culture, belief, and income status (Erten, 2003; Erten, 2004; Erten, 2019; Escobar, 1995; Nag & Vizayakumar, 2005; Rees, 1995). The main cause of environmental issues is the disruption of the balance between the living and non-living elements that make up the environment by human behavior. We are witnessing a rapid increase in environmental issues such as plants and animals becoming extinct, environmental pollution, acid rain, garbage and waste problems, global warming, and

climate change. Scientists cite human behavior as the cause of these problems (Dunlap et al., 2000; Nordlund & Garvill 2002; Oskamp 2000; Schultz, et al., 2005). Developments in technology and industry are among the causes of environmental issues. Humans unthinkingly use natural resources to meet their unending needs due to population growth. However, these natural resources are limited. Although unthinking use of resources meets human needs, it also irreversibly harms the environment.

Another concept that affects environmental issues is globalization. Globalization has moved all the variables from the national domain to the international one. All countries now influence one another economically, politically, socially, and culturally. As a result, access to information has become easier, intercultural communication has increased, and life has become more modern (Hammond & Grosse, 2003). This communication facilitates cooperation in finding solutions to problems that affect the whole world, such as environmental issues. Although this seems to be a positive situation, globalization also plays a role in increasing environmental issues (Khor, 2001). The modern life resulting from globalization has also affected the relationship between man and nature. Man has imposed a limitless burden on nature in an effort to meet its needs. Mankind sees itself as superior to nature. Yet man is as much a part of nature as all other living things. It needs nature to live. In other words, man is not the master of nature but an integral part of it. Mankind's achievements in industry and technology have disrupted the balance between man and nature. These achievements have increased unconscious waste and consumption (Baykal & Baykal, 2008). Exploiting nature is now commonplace behavior. Examples of this irresponsible behavior include deforestation, the use of poor-quality coal, uncontrolled population growth, increased energy per capita, the use of pesticides and artificial fertilizers, hunting, irrigation without treating the water first to rid it of domestic or industrial wastes, unconscious use of fossil fuels, greenhouse gases, and not using public transportation/mass transit systems. Examples of environmental issues include air, water, and soil pollution, loss of biodiversity, plants, and animals becoming endangered or on the verge of extinction, global warming, ozone depletion, acid rain, and the climate crisis.

#### **The Emergence of Environmental Issues**

The turning point for environmental issues is the Industrial Revolution. Human welfare is improving as a result of advances in industry and technology. This in turn is causing rapid population growth. There is a corresponding, even unlimited, increase in the need for shelter, food, and energy. The natural resources to meet all these needs are limited. This shows the many human behaviors that cause environmental issues. Environmental issues have become the topic of many scientific studies in recent years. The fact that these problems are global is a matter of great concern for the whole world. This is why it is often on the world agenda. Some developments in the 1960s revealed how vitally important environmental issues are. The first of these is large-scale deaths



due to air pollution in Europe. One example of this is the London Fog-*The Great Smoke* of London. London had the coldest winter in 80 years in 1952. Power plants and factories also unconsciously started to use excessive coal to continue production in order to protect the city inhabitants from the cold. The decisions taken by the UK to achieve maximum efficiency and profit from coal turned London Smoke into Killer Fog. The use of poor-quality coal saw a corresponding increase in the release of sulfur dioxide and sulfuric acid. This caused local air pollution. All these harmful gases descended on the city as fog resulting in the death of 12,000 people. This and similar events have led man to start seeing himself as a being not superior to nature and to think about the future. Studies to date have shown that more than half of environmental issues emerged after 1960 (Şahin, 2020).

## Figure 1.

The Great Smoke of London (https://www.bbc.co.uk/archive/great-smog-of-london/zhjx7nb)



Another development is Rachel Carson's book Silent Spring, published in 1962. Environmental issues are emphasized as a concept for the first time in this book. The author describes the damage caused to the soil by the pesticides used to get rid of agricultural pests. The book launched a great environmental movement against the use of chemicals in agriculture (Şahin, 2020).

## **Figure 2.** *Rachel Carson & Silent Spring*



One event regarded as being instrumental in the emergence of environmental issues and their becoming current is the pessimistic view of the future painted by the reports written in the 1960s. The biggest example of this is the Club of Rome's report titled The Limits to Growth. The report emphasizes the significant increase in population, developments in industry, environmental issues, and the rapid disappearance of natural resources. All these variables are considered in detail on how they will affect the global economy. Finally, the launch of environmental organizations such as Greenpeace, founded to draw attention to environmental issues, played a role in bringing these problems to the agenda. This process has been accelerated by the establishment of environmentalist political parties and the fact that these parties have found significant support. In short, almost every country had to put environmental issues on the agenda in the 1960s and 1970s (Şahin, 2012).

#### **Seeking Solutions to Environmental Issues**

Living in a healthy environment is a fundamental right of every human being. According to Article 56 of the Constitution of the Republic of Turkey, *everyone has the right to live in a healthy and balanced environment. It is the duty of the state and the citizen to improve the environment, protect environmental health, and prevent pollution of the environment.* " The current state of environmental issues shows that humanenvironment interaction is vital. Finding solutions to these issues is not simply a national concern. Environment and Forestry, 2008). Bleak scenarios for the future increased after the 1970s fueled by the huge losses caused by environmental issues. Scenarios such as the daily increase in global warming will melt the polar ice caps. The oceans will rise as a result of the melting glaciers. The raised water levels will affect the people living in those areas. The increase in temperature will also cause drought. The climate will result in places becoming uninhabitable. People will migrate from these areas in droves. These huge waves of migration will affect relations between countries, perhaps causing wars. Drought will also result in epidemics. All of this has made the search for solutions to environmental issues a global one.

When we look at how solutions to environmental issues have been sought throughout history, we can consider Carson's definition of environmental issues in her book Silent Spring in 1962 to be a turning point. Then, in **1972**, the UN held the **United Nations Conference on the Human Environment**. This conference saw environmental issues discussed globally for the first time. Emphasis was placed on what needs to be done to leave a healthy environment for future generations. It was against this backdrop that the establishment of an international system to address environmental issues on a global scale came to the fore. The **UN Program was established within the UN** and under its leadership. Since its establishment, UNEP has played a key role in many important protocols and conventions. These are listed in the table below.

#### Table 1.

*Conventions and Protocols after UNEP* (MFA, 2016, Republic of Turkey Ministry of Foreign Affairs, 2023).

	Year	<b>Convention/Protocol</b>	Significance
1	1973	CITES Convention	International protection of endangered plants and
			animals
2	1979	BONN Convention	Conservation of Migratory Species of Wild
			Animals
3	1985	Vienna Convention	Protection of the ozone layer
4	1987	Montreal Protocol	Protection of the ozone layer
5	1989	Basel Convention	Control of the movement and disposal of
			hazardous wastes
6	1992	Convention on Biological	International protection of endangered plants and
		Diversity	animals
7	1998	Rotterdam Convention	International trade in certain hazardous chemicals
			and pesticides
8	2001	Stockholm Convention	On persistent organic pollutants

Following the establishment of *UNEP*, the "*International Environment Conference*" was held in *Tbilisi* in 1977. One of the most important topics of the Tbilisi Declaration is environmental education. Environmental education was on the agenda at this conference, making this the first time the topic was discussed in an international context. Global cooperation is required to achieve the goals and objectives of environmental education (UNESCO, 1977). Besides, the main purpose of environmental education is to raise generations who will find solutions to environmental issues. Environmental education is an important tool for providing individuals with all the knowledge, skills, values, and attitudes required to adopt environmentally friendly behaviors (Erten, 2002; 2004). The **1987** Brundlant (**Our Common Future**) **Report** introduced the concept of sustainable development. Similarly, this report drew attention to such environmental issues as global warming, drought, and the depletion of the ozone layer. The **Rio Declaration** was published in **1992** followed by the Climate Crisis Convention, the Biodiversity Framework Convention, and the Agenda 21 Plans. **Agenda 21** in **1992** resulted in an international consensus being reached on the principles of sustainable development. The concepts of Education and community awareness for Sustainable Development were introduced here. The international agenda in the 2000s focused more on climate change. The **Kyoto Protocol** of **2005** aims to address climate change and reduce greenhouse gas emissions. The **Paris Agreement** of **2015** is an international agreement to prevent a climate crisis signed under the UN Framework Convention on Climate Change.

#### Is Climate Change the Most Important Environmental Issue?

When we look at the search for solutions to environmental issues from an international perspective, we see that the most emphasized issue in recent years is climate change (Köseoğlu & Erten, 2022). This is why the climate crisis was treated as a major topic at all meetings on environmental issues from the Rio Convention in 1992 to the Paris Agreement in 2015. The Ministry of Environment and Urbanization of the Republic of Turkey even changed its name to the Ministry of Environment, Urbanization and Climate Change of the Republic of Turkey in 2022 to reflect this. A course on Environmental Education and Climate Change has been added to all secondary school curricula. All this highlights why climate change should be treated as a separate topic.

According to the UN Framework Convention on Climate Change, climate change is the changes that occur in the climate as a result of human behaviors that adversely affect the balance of the global atmosphere in addition to naturally occurring changes in the climate (UNEP, 1975). According to this definition, human behavior is the main cause of climate change. The disruption by human hands of the balance between the living and non-living elements that make up the environment is already creating environmental issues. Although these changes in the climate seem to be an environmental issue in itself, they are the result of many existing environmental issues. The most important consequence of climate change caused by human behavior is global warming. Climate change and global warming are two interrelated concepts. Climate change emerges as a larger concept that includes global warming and cooling. The Earth's temperature has risen then fallen many times throughout the planet's history. This is a natural process that occurs due to the way nature functions. But the reason for the increase we are seeing in the Earth's temperature today is man. This is why the change is unlike any other before it. The Earth's temperature has been gradually rising since the beginning of industrialization in 1800, in particular (Şahin, 2012). The destruction of forests and the unconscious and excessive use of fossil fuels increase the amounts of methane, carbon dioxide, ozone, and dinitrogen monoxide in the atmosphere. These gases keep the temperature of the Earth at 14 degrees Celsius. The change in the ratio of these gases in the atmosphere directly affects the temperature of the Earth. These effects result in the climate crisis (Erten, 2004). The possible consequences of climate change include the following:

- Unusual temperature changes will adversely affect vital health, increasing epidemics and mass mortality rates. The inexorable increase in temperature will lead to drought and desertification.
- Extraordinary changes in the seasons will cause melting in areas with permanent snow and ice cover, resulting in disasters such as avalanches, floods, and high waters. As the seas rise, the relatively low areas where there is habitation and agriculture will end up underwater.
- The melting glaciers and large currents in the oceans will affect the salinity of the seas and disrupt the order of the currents. This in turn will cause irregularities in the normal formation of climates.
- Changes in sea currents will adversely affect marine ecosystems and impact life in those regions. Mankind can expect to encounter great hardships, particularly in finding sources of drinking water (Candan & Erten, 2015).

This is why the biggest step man can take to leave a habitable planet for future generations is to seek solutions not only to climate change but also to all environmental issues. But this step can only be taken with environmentally friendly societies. This is possible by raising the individuals who make up the societies, the teachers who raise them, and the teacher candidates who will go on to raise them in an environmentally friendly way.

## The United Nation's Sustainable Development Goals for 2030

When we examine the steps taken to find solutions to environmental issues, we see that the concepts of sustainability and sustainable development are frequently articulated after the 1990s (Çayırağası & Sayı, 2021). The Brundtland Report, organized by the UN in 1987, is where these concepts were first put forward. This report states that mankind needs to consider the resources of future generations while meeting its needs today. These resources are the most important legacy we will leave for the future (Singh, 2020; United Nations, 1987). In other words, sustainable development is a model for how to protect the environment while meeting human needs. Economic and ecological development should be mutually supportive. The Rio Declaration in 1992 builds on the 1987 report and takes it further. It states that sustainable development has three pillars. These are the economic dimension, the social dimension, and the environmental

dimension (Choudhary & Gokarn, 2013; Meakin, 1992; Bebbington & Unerman, 2018). Knowledge and awareness of sustainable development are key to solving environmental issues. The search for solutions to environmental issues is a global responsibility. The whole world needs to collaborate on this. The UN's Sustainable Development Goals are an important example of such collaboration. They have been adopted by 193 UN members and should be achieved by the end of 2030. Constituting a global and universal call to action, the goals were first adopted in 2016. The Paris Agreement is regarded as the starting point for the UN Sustainable Development Goals. This agreement entered into force in 2015 intending to find a global solution to climate change, which seriously affects human existence. In the period before the Paris Agreement, the UN Millennium Development Goals, covering the years 2000-2015, pursued the same goal. The Sustainable Development Goals are an improved version of the same goals that were introduced by the OECD in 1996 (Bebbington & Unerman, 2018). The Sustainable Development Goals have 17 main objectives and 169 related sub-objectives. The following figure and table present these objectives in detail. Figure 3.

Sustainable Development Goals




## Table 2

Sustainable Development Goals

Goal Number	Goal Name	Number of Countries Capable	Description
1	No Poverty	31	End poverty in all its forms everywhere by 2030
2	Zero Hunger	0	- End hunger, achieve food security, improve nutrition, and promote sustainable agriculture
3	Good Health and Well-Being	0	Ensure healthy lives and promote well- being for all at all ages.
4	Quality Education	16	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5	Gender Equality	5	Achieve gender equality and empower all women and girls
6	Clean Water and Sanitation	0	Ensure availability and sustainable management of water and sanitation for all
7	Affordable and Clean Energy	11	Ensure access to affordable, reliable, sustainable, and modern energy for all
8	Decent Work and Economic Growth	2	Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all
9	Industry, Innovation and	1	Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster inpovation
10	Reducing Inequality	9	Reduce inequality within and among countries
11	Sustainable Cities and Communities	0	Make cities and human settlements inclusive, safe, resilient, and sustainable
12	Responsible Consumption and Production	26	Ensure sustainable consumption and production patterns
13	Climate Action	20	Take urgent action to combat climate change and its impacts

			Conserve and sustainably use the oceans,
14	Life Below Water	0	seas, and marine resources for sustainable development
15	Life on Land	4	<ul> <li>Protect, restore, and promote sustainable</li> <li>use of terrestrial ecosystems, sustainably</li> <li>manage forests, combat desertification,</li> <li>halt reverse land degradation, and halt</li> <li>biodiversity loss</li> </ul>
16	Peace, Justice and Strong Institutions	2	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels
17	Partnerships for Goals	1	Strengthening the means for implementation and revitalizing the Global Partnership for Sustainable Development

The table above was prepared according to 2023 data. When the relevant table is examined, it is seen that the situation is not very bright all over the world. The Poverty Reduction goal has been achieved the most. The number of countries achieving this goal is 31. Considering that there are 193 countries that have accepted these goals, it can be seen that the realization rate of the most successful goal is only 16%. It is known that all countries create action plans to achieve these goals. There are five codes (blue, green, yellow, orange and red) according to the level of realization of Sustainable Developmet Goals. Thanks to these codes, the level of realization of the 17 goals can be easily understood on a country basis. The explanations of these codes are as follows:

## Table 3.

Code Number	Code	Description
1	Green	SDG achieved
2	Yellow	<b>Challenges remain</b>
3	Orange	Significant challenges remain
4	Red	Major challenges remain
5	Blue	Information unavailable

## Codes for Sustainable Development Goals

The blue code indicates that the information unavailable, the green code indicates that the information has been achieved, the yellow code indicates that challenges remain, the orange code indicates that significant challenges remain, and the red code indicates that major challenges remain. Everyone can access up-to-date information about the 2022 Sustainable Development Report prepared by the University of Cambridge from



the official website prepared specifically for this report (<u>https://dashboards.sdgindex.</u> org/). As an example, the situation of the No Poverty goal in the world is given in the picture below.

## Figure 4.

Report of the No Poverty goal in 2023



## Türkiye's Current Situation on Sustainable Development Goals

While Türkiye moves its country forward economically and socially in its development journey from past to future, it also prioritizes the protection and improvement of the environment in line with its global responsibilities. In this context, Turkey emphasizes at every opportunity that it is ready to contribute to a sustainable world since the adoption of the 2030 Sustainable Development Agenda. Türkiye's position on Sustainable Development Goals is summarized below.

## Figure 5.

Türkiye's position on Sustainable Development Goals



Goal Number	Goal Name	Turkey's Code	Goal Number	Goal Name	Turkey's Code
1	No Poverty	Code Yellow	10	Reducing Inequality	Code Red
2	Zero Hunger	Code Orange	11	Sustainable Cities and Communities	Code Orange
3	Good Health and Well-being	Code Red	12	Responsible Consumption and Production	Code Yellow
4	Quality Education	Code Orange	13	Climate Action	Code Red
5	Gender Equality	Code Red	14	Life Below Water	Code Red
6	Clean Water and Sanitation	Code Orange	15	Life on Land	Code Red
7	Affordable and Clean Energy	Code Yellow	16	Peace, Justice and Strong Institutions	Code Red
8	Decent Work and Economic Growth	Code Red	17	Partnerships for Goals	Code Orange
9	Industry, Innovation and Infrastructure	Code Red			

## Table 4.

Türkiye's position on Sustainable Development Goals

When the relevant table is analyzed, it is seen that Türkiye has not achieved the green code in any of the 17 goals by 2023. Again, none of the 17 goals is marked with a blue code. This is an indication that the data is open for all 17 goals. When the relevant table is analyzed, it is seen that Türkiye is marked with a yellow code in three goals. This shows that there are still significant challenges in poverty reduction, Affordable and Clean Energy and responsible consumption and production. There are five goals where Türkiye is struggling with great difficulties to achieve the goal. These goals are zero hunger, quality education, clean water and sanitation, sustainable cities and communities, and partnerships for the goals. These goals are marked with an orange code. Current data shows that Türkiye is still struggling with major challenges in 9 of the 17 goals. All these goals are marked with code red. Gender equality, climate action, Life Below Water, life on land, peace, justice and strong institutions are the goals marked with code red.

When current developments are examined, there is significant progress for Türkiye in the goals of No Poverty, Good Health and Well-being, Clean Water and Sanitation,



Industry, Innovation and Infrastructure and Sustainable Cities and Communities. Unfortunately, there is no progress in other goals. However, efforts on this issue continue. It is anticipated that as the country develops technically and economically, there will be developments towards these goals. Turkey has come a long way with the impact of social policies implemented on issues such as reducing poverty, providing access to basic services, eliminating inequalities, and protecting vulnerable groups. In particular, policies aimed at reducing interregional infrastructure differences and spreading technological opportunities throughout the country have created an inclusive development path. In the next process; Efforts will be focused on continuing progress and further improving the quality of services provided. In line with the principle of equity, efforts will continue to spread the effects of welfare increase in a balanced manner to all segments of society, especially vulnerable groups (TR Presidency of Strategy and Budget, 2019).

Current Studies in Environmental Education

**Figure 6.** *Türkiye's position on Sustainable Development Goals* 

# SDG DASHBOARDS AND TRENDS



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SDG

10

7

SDG

8

sog 9

Note: The full title of each SDG is available here: https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals

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## **About The Author**





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## Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development

Sustainable Development Goal indicators should be disaggregated, where relevant, by income, sex, age, race, ethnicity, migratory status, disability and geographic location, or other characteristics, in accordance with the Fundamental Principles of Official Statistics.<sup>1</sup>

#### Goals and targets (from the 2030 Agenda for Sustainable Development) Indicators

#### Goal 1. End poverty in all its forms everywhere

1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day

1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions

1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable

1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance

1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters

1.1.1 Proportion of the population living below the international poverty line by sex, age, employment status and geographic location (urban/rural)

1.2.1 Proportion of population living below the national poverty line, by sex and age

1.2.2 Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions

1.3.1 Proportion of population covered by social protection floors/systems, by sex, distinguishing children, unemployed persons, older persons, persons with disabilities, pregnant women, newborns, work-injury victims and the poor and the vulnerable

1.4.1 Proportion of population living in households with access to basic services

1.4.2 Proportion of total adult population with secure tenure rights to land, (a) with legally recognized documentation, and (b) who perceive their rights to land as secure, by sex and type of tenure

1.5.1  $\,$  Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population

1.5.2 Direct economic loss attributed to disasters in relation to global gross domestic product (GDP)

1.5.3 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030

<sup>1</sup> Resolution 68/261.

Indicators

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#### Goals and targets (from the 2030 Agenda for Sustainable Development)

 1.a Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for development in particular least development.
 1.a.1 Total or all donors that recipient count

means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions

1.b Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions 1.5.4 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies

1.a.1 Total official development assistance grants from all donors that focus on poverty reduction as a share of the recipient country's gross national income

1.a.2 Proportion of total government spending on essential services (education, health and social protection)

1.b.1 Pro-poor public social spending

#### Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round

2.2 By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons

2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment

2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality 2.1.1 Prevalence of undernourishment

2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)

2.2.1 Prevalence of stunting (height for age <-2 standard deviation from the median of the World Health Organization (WHO) Child Growth Standards) among children under 5 years of age

2.2.2 Prevalence of malnutrition (weight for height >+2 or <-2 standard deviation from the median of the WHO Child Growth Standards) among children under 5 years of age, by type (wasting and overweight)

2.2.3 Prevalence of anaemia in women aged 15 to 49 years, by pregnancy status (percentage)

2.3.1 Volume of production per labour unit by classes of farming/pastoral/forestry enterprise size

2.3.2 Average income of small-scale food producers, by sex and indigenous status

2.4.1 Proportion of agricultural area under productive and sustainable agriculture

#### Goals and targets (from the 2030 Agenda for Sustainable Development)

Current Studies in Environmental Education

2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed

2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries

2.b Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round

2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility

#### Goal 3. Ensure healthy lives and promote well-being for all at all ages

3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births

3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births

3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases

2.5.1 Number of (a) plant and (b) animal genetic resources for food and agriculture secured in either medium- or long-term conservation facilities

Indicators

2.5.2 Proportion of local breeds classified as being at risk of extinction

2.a.1 The agriculture orientation index for government expenditures

2.a.2 Total official flows (official development assistance plus other official flows) to the agriculture sector

2.b.1 Agricultural export subsidies

2.c.1 Indicator of food price anomalies

3.1.1 Maternal mortality ratio

3.1.2 Proportion of births attended by skilled health personnel

- 3.2.1 Under-5 mortality rate
- 3.2.2 Neonatal mortality rate

3.3.1 Number of new HIV infections per 1,000 uninfected population, by sex, age and key populations

3.3.2 Tuberculosis incidence per 100,000 population

- 3.3.3 Malaria incidence per 1,000 population
- 3.3.4 Hepatitis B incidence per 100,000 population

3.3.5 Number of people requiring interventions against neglected tropical diseases

3.4.1 Mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease

#### Goals and targets (from the 2030 Agenda for Sustainable Development)

3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being

3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol

3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents

3.7 By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes

3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all

3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination

3.a Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate

3.b Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all

3.4.2 Suicide mortality rate

Indicators

3.5.1 Coverage of treatment interventions (pharmacological, psychosocial and rehabilitation and aftercare services) for substance use disorders

3.5.2 Alcohol per capita consumption (aged 15 years and older) within a calendar year in litres of pure alcohol

3.6.1 Death rate due to road traffic injuries

3.7.1 Proportion of women of reproductive age (aged 15–49 years) who have their need for family planning satisfied with modern methods

3.7.2 Adolescent birth rate (aged 10–14 years; aged 15–19 years) per 1,000 women in that age group

3.8.1 Coverage of essential health services

3.8.2 Proportion of population with large household expenditures on health as a share of total household expenditure or income

3.9.1 Mortality rate attributed to household and ambient air pollution

3.9.2 Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services)

3.9.3 Mortality rate attributed to unintentional poisoning

3.a.1 Age-standardized prevalence of current tobacco use among persons aged 15 years and older

3.b.1 Proportion of the target population covered by all vaccines included in their national programme

3.b.2 Total net official development assistance to medical research and basic health sectors

3.b.3 Proportion of health facilities that have a core set of relevant essential medicines available and affordable on a sustainable basis



#### Goals and targets (from the 2030 Agenda for Sustainable Development)

3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States

3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks

3.c.1 Health worker density and distribution

Indicators

3.d.1 International Health Regulations (IHR) capacity and health emergency preparedness

3.d.2 Percentage of bloodstream infections due to selected antimicrobial-resistant organisms

#### Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes

4.2 By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education

4.3 By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university

4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship

4.5 By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations

4.6 By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy

4.1.1 Proportion of children and young people (a) in grades 2/3; (b) at the end of primary; and (c) at the end of lower secondary achieving at least a minimum proficiency level in (i) reading and (ii) mathematics, by sex

4.1.2 Completion rate (primary education, lower secondary education, upper secondary education)

4.2.1 Proportion of children aged 24-59 months who are developmentally on track in health, learning and psychosocial well-being, by sex

4.2.2 Participation rate in organized learning (one year before the official primary entry age), by sex

4.3.1 Participation rate of youth and adults in formal and non-formal education and training in the previous 12 months, by sex

4.4.1 Proportion of youth and adults with information and communications technology (ICT) skills, by type of skill

4.5.1 Parity indices (female/male, rural/urban, bottom/top wealth quintile and others such as disability status, indigenous peoples and conflict-affected, as data become available) for all education indicators on this list that can be disaggregated

4.6.1 Proportion of population in a given age group achieving at least a fixed level of proficiency in functional (a) literacy and (b) numeracy skills, by sex

Goals and targets (from the 2030 Agenda for Sustainable Development)

Indicators

4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development

4.a Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all

4.b By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries

4.c By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States

#### Goal 5. Achieve gender equality and empower all women and girls

5.1 End all forms of discrimination against all women and girls everywhere

5.2 Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation

5.3 Eliminate all harmful practices, such as child, early and forced marriage and female genital mutilation

4.7.1 Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment

4.a.1 Proportion of schools offering basic services, by type of service

4.b.1 Volume of official development assistance flows for scholarships by sector and type of study

4.c.1 Proportion of teachers with the minimum required qualifications, by education level

5.1.1 Whether or not legal frameworks are in place to promote, enforce and monitor equality and non-discrimination on the basis of sex

5.2.1 Proportion of ever-partnered women and girls aged 15 years and older subjected to physical, sexual or psychological violence by a current or former intimate partner in the previous 12 months, by form of violence and by age

5.2.2 Proportion of women and girls aged 15 years and older subjected to sexual violence by persons other than an intimate partner in the previous 12 months, by age and place of occurrence

5.3.1 Proportion of women aged 20-24 years who were married or in a union before age 15 and before age 18

5.3.2 Proportion of girls and women aged 15-49 years who have undergone female genital mutilation, by age



#### Goals and targets (from the 2030 Agenda for Sustainable Development)

Indicators

5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate

5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life

5.6 Ensure universal access to sexual and reproductive health and reproductive rights as agreed in accordance with the Programme of Action of the International Conference on Population and Development and the Beijing Platform for Action and the outcome documents of their review conferences

5.a Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws

5.b Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women

5.c Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels

#### Goal 6. Ensure availability and sustainable management of water and sanitation for all

6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all

6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

5.4.1 Proportion of time spent on unpaid domestic and care work, by sex, age and location

5.5.1 Proportion of seats held by women in (a) national parliaments and (b) local governments

5.5.2 Proportion of women in managerial positions

5.6.1 Proportion of women aged 15–49 years who make their own informed decisions regarding sexual relations, contraceptive use and reproductive health care

5.6.2 Number of countries with laws and regulations that guarantee full and equal access to women and men aged 15 years and older to sexual and reproductive health care, information and education

5.a.1 (a) Proportion of total agricultural population with ownership or secure rights over agricultural land, by sex; and (b) share of women among owners or rights-bearers of agricultural land, by type of tenure

5.a.2 Proportion of countries where the legal framework (including customary law) guarantees women's equal rights to land ownership and/or control

5.b.1 Proportion of individuals who own a mobile telephone, by sex

5.c.1 Proportion of countries with systems to track and make public allocations for gender equality and women's empowerment

6.1.1 Proportion of population using safely managed drinking water services

6.2.1 Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water

#### Goals and targets (from the 2030 Agenda for Sustainable Development)

Indicators

6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

6.a By 2030, expand international cooperation and capacity-building support to developing countries in waterand sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

6.b Support and strengthen the participation of local communities in improving water and sanitation management 6.3.1 Proportion of domestic and industrial wastewater flows safely treated

6.3.2 Proportion of bodies of water with good ambient water quality

6.4.1 Change in water-use efficiency over time

6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources

6.5.1 Degree of integrated water resources management

6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation

6.6.1 Change in the extent of water-related ecosystems over time

6.a.1 Amount of water- and sanitation-related official development assistance that is part of a governmentcoordinated spending plan

6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management

#### Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services

7.2 By 2030, increase substantially the share of renewable energy in the global energy mix

7.3 By 2030, double the global rate of improvement in energy efficiency

7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology

7.1.1 Proportion of population with access to electricity

7.1.2 Proportion of population with primary reliance on clean fuels and technology

7.2.1 Renewable energy share in the total final energy consumption

7.3.1 Energy intensity measured in terms of primary energy and GDP

7.a.1 International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems

#### Goals and targets (from the 2030 Agenda for Sustainable Development)

Indicators

7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support

#### Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

8.1 Sustain per capita economic growth in accordance with 8.1.1 Annual growth rate of real GDP per capita national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries

8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors

8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services

8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead

8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value

8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training

8.7 Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms

developing countries (in watts per capita)

7.b.1 Installed renewable energy-generating capacity in

8.2.1 Annual growth rate of real GDP per employed person

8.3.1 Proportion of informal employment in total employment, by sector and sex

8.4.1 Material footprint, material footprint per capita, and material footprint per GDP

8.4.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP

8.5.1 Average hourly earnings of employees, by sex, age, occupation and persons with disabilities

8.5.2 Unemployment rate, by sex, age and persons with disabilities

8.6.1 Proportion of youth (aged 15-24 years) not in education, employment or training

8.7.1 Proportion and number of children aged 5-17 years engaged in child labour, by sex and age

Goals and targets (from the 2030 Agenda for Sustainable Development) Indicators 8.8 Protect labour rights and promote safe and secure 8.8.1 Fatal and non-fatal occupational injuries per working environments for all workers, including migrant 100,000 workers, by sex and migrant status workers, in particular women migrants, and those in 8.8.2 Level of national compliance with labour rights precarious employment (freedom of association and collective bargaining) based on International Labour Organization (ILO) textual sources and national legislation, by sex and migrant status 8.9 By 2030, devise and implement policies to promote 8.9.1 Tourism direct GDP as a proportion of total GDP sustainable tourism that creates jobs and promotes local and in growth rate culture and products 8.10 Strengthen the capacity of domestic financial 8.10.1 (a) Number of commercial bank branches per institutions to encourage and expand access to banking, 100,000 adults and (b) number of automated teller insurance and financial services for all machines (ATMs) per 100,000 adults 8.10.2 Proportion of adults (15 years and older) with an account at a bank or other financial institution or with a mobile-money-service provider 8.a Increase Aid for Trade support for developing 8.a.1 Aid for Trade commitments and disbursements countries, in particular least developed countries, including through the Enhanced Integrated Framework for Traderelated Technical Assistance to Least Developed Countries 8.b By 2020, develop and operationalize a global strategy 8.b.1 Existence of a developed and operationalized for youth employment and implement the Global Jobs Pact national strategy for youth employment, as a distinct strategy or as part of a national employment strategy of the International Labour Organization Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation 9.1 Develop quality, reliable, sustainable and resilient 9.1.1 Proportion of the rural population who live within infrastructure, including regional and transborder 2 km of an all-season road infrastructure, to support economic development and human 9.1.2 Passenger and freight volumes, by mode of well-being, with a focus on affordable and equitable access transport for all 9.2 Promote inclusive and sustainable industrialization 9.2.1 Manufacturing value added as a proportion of GDP

and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries

9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets 9.2.1 Manufacturing value added as a proportion of GDP and per capita

9.2.2 Manufacturing employment as a proportion of total employment

9.3.1 Proportion of small-scale industries in total industry value added

 $9.3.2 \ \ \, \mbox{Proportion of small-scale industries with a loan or line of credit}$ 



Goals and targets (from the 2030 Agenda for Sustainable Development)

### Indicators

9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities

9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending

9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States

9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities

9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020

#### Goal 10. Reduce inequality within and among countries

10.1 By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average

10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status

10.3 Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard

9.4.1 CO2 emission per unit of value added

9.5.1 Research and development expenditure as a proportion of  $\operatorname{GDP}$ 

 $9.5.2 \quad \text{Researchers (in full-time equivalent) per million} \\ \text{inhabitants}$ 

9.a.1 Total official international support (official development assistance plus other official flows) to infrastructure

9.b.1 Proportion of medium and high-tech industry value added in total value added

9.c.1 Proportion of population covered by a mobile network, by technology

10.1.1 Growth rates of household expenditure or income per capita among the bottom 40 per cent of the population and the total population

10.2.1 Proportion of people living below 50 per cent of median income, by sex, age and persons with disabilities

10.3.1 Proportion of population reporting having personally felt discriminated against or harassed in the previous 12 months on the basis of a ground of discrimination prohibited under international human rights law

10.4.1 Labour share of GDP

Indicators

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#### Goals and targets (from the 2030 Agenda for Sustainable Development)

10.4 Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality

10.5 Improve the regulation and monitoring of global financial markets and institutions and strengthen the implementation of such regulations

10.6 Ensure enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions

10.7 Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies

10.a Implement the principle of special and differential treatment for developing countries, in particular least developed countries, in accordance with World Trade Organization agreements

10.b Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programmes

10.c By 2030, reduce to less than 3 per cent the transaction costs of migrant remittances and eliminate remittance corridors with costs higher than 5 per cent

10.4.2 Redistributive impact of fiscal policy<sup>2</sup>

10.5.1 Financial Soundness Indicators

10.6.1 Proportion of members and voting rights of developing countries in international organizations

10.7.1 Recruitment cost borne by employee as a proportion of monthly income earned in country of destination

10.7.2 Proportion of countries with migration policies that facilitate orderly, safe, regular and responsible migration and mobility of people

10.7.3 Number of people who died or disappeared in the process of migration towards an international destination

10.7.4 Proportion of the population who are refugees, by country of origin

10.a.1 Proportion of tariff lines applied to imports from least developed countries and developing countries with zero-tariff

10.b.1 Total resource flows for development, by recipient and donor countries and type of flow (e.g. official development assistance, foreign direct investment and other flows)

10.c.1 Remittance costs as a proportion of the amount remitted

#### Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums

11.1.1 Proportion of urban population living in slums, informal settlements or inadequate housing

<sup>2</sup> The Gini Coefficient will be reported as a second series in the database, as it is a component of this indicator.



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Carls and tenants (from the 2020 Arounds for Sustainable Development)	T. J stars
Goals and largets (from the 2050 Agenca for sustainable Development)	Indicators
11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons	11.2.1 Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities
11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and	11.3.1 Ratio of land consumption rate to population growth rate
all countries	11.3.2 Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically
11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage	11.4.1 Total per capita expenditure on the preservation, protection and conservation of all cultural and natural heritage, by source of funding (public, private), type of heritage (cultural, natural) and level of government (national, regional, and local/municipal)
11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic	11.5.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population
disasters, with a focus on protecting the poor and people in vulnerable situations	11.5.2 Direct economic loss attributed to disasters in relation to global gross domestic product (GDP)
	11.5.3 (a) Damage to critical infrastructure and $(b)$ number of disruptions to basic services, attributed to disasters
11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.1 Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities
	11.6.2 Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)
11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with	11.7.1 Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities
disabilities	11.7.2 Proportion of persons victim of physical or sexual harassment, by sex, age, disability status and place of occurrence, in the previous 12 months
11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning	11.a.1 Number of countries that have national urban policies or regional development plans that $(a)$ respond to population dynamics; $(b)$ ensure balanced territorial development; and $(c)$ increase local fiscal space
11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource	11.b.1 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030

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#### Goals and targets (from the 2030 Agenda for Sustainable Development) Indicators

efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels

11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials

#### Goal 12. Ensure sustainable consumption and production patterns

12.1 Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries

12.2 By 2030, achieve the sustainable management and efficient use of natural resources

12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses

12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment

12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse

12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle

12.7 Promote public procurement practices that are sustainable, in accordance with national policies and priorities

12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature

11.b.2 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies

No suitable replacement indicator was proposed. The global statistical community is encouraged to work to develop an indicator that could be proposed for the 2025 comprehensive review. See E/CN.3/2020/2, paragraph 23

12.1.1 Number of countries developing, adopting or implementing policy instruments aimed at supporting the shift to sustainable consumption and production

 $12.2.1\,$  Material footprint, material footprint per capita, and material footprint per GDP

12.2.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP

12.3.1 (a) Food loss index and (b) food waste index

12.4.1 Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement

12.4.2 (*a*) Hazardous waste generated per capita; and (*b*) proportion of hazardous waste treated, by type of treatment

12.5.1 National recycling rate, tons of material recycled

12.6.1 Number of companies publishing sustainability reports

12.7.1 Number of countries implementing sustainable public procurement policies and action plans

12.8.1 Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment

#### Goals and targets (from the 2030 Agenda for Sustainable Development) Indicators

12.a Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production

12.b Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products

12.c Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities 12.a.1 Installed renewable energy-generating capacity in developing countries (in watts per capita)

12.b.1 Implementation of standard accounting tools to monitor the economic and environmental aspects of tourism sustainability

12.c.1 Amount of fossil-fuel subsidies (production and consumption) per unit of GDP

#### Goal 13. Take urgent action to combat climate change and its impacts<sup>3</sup>

13.1 Strengthen resilience and adaptive capacity to climaterelated hazards and natural disasters in all countries 13.1.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population

13.1.2 Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030

13.1.3 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies

13.2 Integrate climate change measures into national policies, strategies and planning

13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning 13.2.1 Number of countries with nationally determined contributions, long-term strategies, national adaptation plans and adaptation communications, as reported to the secretariat of the United Nations Framework Convention

13.2.2 Total greenhouse gas emissions per year

on Climate Change

13.3.1 Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment

<sup>&</sup>lt;sup>3</sup> Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

#### Goals and targets (from the 2030 Agenda for Sustainable Development) Indicators

13.a Implement the commitment undertaken by developedcountry parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible

13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities 13.a.1 Amounts provided and mobilized in United States dollars per year in relation to the continued existing collective mobilization goal of the \$100 billion commitment through to 2025

13.b.1 Number of least developed countries and small island developing States with nationally determined contributions, long-term strategies, national adaptation plans and adaptation communications, as reported to the secretariat of the United Nations Framework Convention on Climate Change

#### Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution

14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans

14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels

14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics

14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information

14.1.1 (a) Index of coastal eutrophication; and (b) plastic debris density

14.2.1 Number of countries using ecosystem-based approaches to managing marine areas

 $14.3.1\,$  Average marine acidity (pH) measured at agreed suite of representative sampling stations

14.4.1 Proportion of fish stocks within biologically sustainable levels

14.5.1 Coverage of protected areas in relation to marine areas



Goals and targets (from the 2030 Agenda for Sustainable Development)	Indicators
14.6 By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation <sup>4</sup>	14.6.1 Degree of implementation of international instruments aiming to combat illegal, unreported and unregulated fishing
14.7 By 2030, increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism	14.7.1 Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries
14.a Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries	14.a.1 Proportion of total research budget allocated to research in the field of marine technology
14.b Provide access for small-scale artisanal fishers to marine resources and markets	14.b.1 Degree of application of a legal/regulatory/ policy/institutional framework which recognizes and protects access rights for small-scale fisheries
14.c Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in the United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of "The future we want"	14.c.1 Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in the United Nations Convention on the Law of the Sea, for the conservation and sustainable use of the oceans and their resources

## Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements

15.1.1 Forest area as a proportion of total land area

15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type

<sup>&</sup>lt;sup>4</sup> Taking into account ongoing World Trade Organization negotiations, the Doha Development Agenda and the Hong Kong ministerial mandate.

Indicators

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#### Goals and targets (from the 2030 Agenda for Sustainable Development)

15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally

15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world

15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development

15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species

15.6 Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed

15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products

15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species

15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts

15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems

15.2.1 Progress towards sustainable forest management

15.3.1 Proportion of land that is degraded over total land area

15.4.1 Coverage by protected areas of important sites for mountain biodiversity

15.4.2 (a) Mountain Green Cover Index and (b) proportion of degraded mountain land

15.5.1 Red List Index

15.6.1 Number of countries that have adopted legislative, administrative and policy frameworks to ensure fair and equitable sharing of benefits

15.7.1 Proportion of traded wildlife that was poached or illicitly trafficked

15.8.1 Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species

15.9.1 (a) Number of countries that have established national targets in accordance with or similar to Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011–2020 in their national biodiversity strategy and action plans and the progress reported towards these targets; and (b) integration of biodiversity into national accounting and reporting systems, defined as implementation of the System of Environmental-Economic Accounting

15.a.1 (a) Official development assistance on conservation and sustainable use of biodiversity; and (b) revenue generated and finance mobilized from biodiversity-relevant economic instruments

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Goals and targets (from the 2030 Agenda for Sustainable Development)	Indicators		
15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation	15.b.1 (a) Official development assistance on conservation and sustainable use of biodiversity; and (b) revenue generated and finance mobilized from biodiversity-relevant economic instruments		
15.c Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities	15.c.1 Proportion of traded wildlife that was poached or illicitly trafficked		
Goal 16. Promote peaceful and inclusive societies for susta and build effective, accountable and inclusive ins	inable development, provide access to justice for all itutions at all levels		
16.1 Significantly reduce all forms of violence and related death rates everywhere	16.1.1 Number of victims of intentional homicide per 100,000 population, by sex and age		
	16.1.2 Conflict-related deaths per 100,000 population, by sex, age and cause		
	16.1.3 Proportion of population subjected to ( <i>a</i> ) physical violence, ( <i>b</i> ) psychological violence and ( <i>c</i> ) sexual violence in the previous 12 months		
	16.1.4 Proportion of population that feel safe walking alone around the area they live after dark		
16.2 End abuse, exploitation, trafficking and all forms of violence against and torture of children	16.2.1 Proportion of children aged 1–17 years who experienced any physical punishment and/or psychological aggression by caregivers in the past month		
	16.2.2 Number of victims of human trafficking per 100,000 population, by sex, age and form of exploitation		
	<ul><li>16.2.3 Proportion of young women and men aged</li><li>18–29 years who experienced sexual violence by age 18</li></ul>		
16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all	16.3.1 Proportion of victims of violence in the previous 12 months who reported their victimization to competent authorities or other officially recognized conflict resolution mechanisms		
	16.3.2 Unsentenced detainees as a proportion of overall prison population		
	16.3.3 Proportion of the population who have experienced a dispute in the past two years and who accessed a formal or informal dispute resolution mechanism, by type of mechanism		

16.4.1 Total value of inward and outward illicit financial flows (in current United States dollars)

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Goals and targets (from the 2030 Agenda for Sustainable Development)	Indicators		
16.4 By 2030, significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organized crime	16.4.2 Proportion of seized, found or surrendered arms whose illicit origin or context has been traced or established by a competent authority in line with international instruments		
16.5 Substantially reduce corruption and bribery in all their forms	16.5.1 Proportion of persons who had at least one contact with a public official and who paid a bribe to a public official, or were asked for a bribe by those public officials, during the previous 12 months		
	16.5.2 Proportion of businesses that had at least one contact with a public official and that paid a bribe to a public official, or were asked for a bribe by those public officials during the previous 12 months		
16.6 Develop effective, accountable and transparent institutions at all levels	16.6.1 Primary government expenditures as a proportion of original approved budget, by sector (or by budget codes or similar)		
	16.6.2 Proportion of population satisfied with their last experience of public services		
16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels	16.7.1 Proportions of positions in national and local institutions, including (a) the legislatures; (b) the public service; and (c) the judiciary, compared to national distributions, by sex, age, persons with disabilities and population groups		
	16.7.2 Proportion of population who believe decision- making is inclusive and responsive, by sex, age, disability and population group		
16.8 Broaden and strengthen the participation of developing countries in the institutions of global governance	16.8.1 Proportion of members and voting rights of developing countries in international organizations		
16.9 By 2030, provide legal identity for all, including birth registration	16.9.1 Proportion of children under 5 years of age whose births have been registered with a civil authority, by age		
16.10 Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements	16.10.1 Number of verified cases of killing, kidnapping, enforced disappearance, arbitrary detention and torture of journalists, associated media personnel, trade unionists and human rights advocates in the previous 12 months		
	16.10.2 Number of countries that adopt and implement constitutional, statutory and/or policy guarantees for public access to information		
16.a Strengthen relevant national institutions, including through international cooperation, for building capacity at all levels, in particular in developing countries, to prevent violence and combat terrorism and crime	16.a.1 Existence of independent national human rights institutions in compliance with the Paris Principles		

Goals and targets (from the 2030 Agenda for Sustainable Development)		Indicators	
16.b Promote and enforce non-discriminatory laws and policies for sustainable development		16.b.1 Proportion of population reporting having personally felt discriminated against or harassed in the previous 12 months on the basis of a ground of	

### rights law Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for

#### Sustainable Development

#### Finance

17.1 Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection

17.2 Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of gross national income for official development assistance (ODA/GNI) to developing countries and 0.15 to 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries

17.3 Mobilize additional financial resources for developing countries from multiple sources

17.4 Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress

17.5 Adopt and implement investment promotion regimes for least developed countries

17.1.1 Total government revenue as a proportion of GDP, by source

discrimination prohibited under international human

17.1.2 Proportion of domestic budget funded by domestic taxes

17.2.1 Net official development assistance, total and to least developed countries, as a proportion of the Organization for Economic Cooperation and Development (OECD) Development Assistance Committee donors' gross national income (GNI)

17.3.1 Additional financial resources mobilized for developing countries from multiple sources

17.3.2 Volume of remittances (in United States dollars) as a proportion of total GDP

17.4.1  $\,$  Debt service as a proportion of exports of goods and services

17.5.1 Number of countries that adopt and implement investment promotion regimes for developing countries, including the least developed countries

#### Technology

#### Goals and targets (from the 2030 Agenda for Sustainable Development)

Indicators

17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledgesharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism

17.7 Promote the development, transfer, dissemination and 17.7.1 Total amount of funding for developing countries diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed

17.8 Fully operationalize the technology bank and science, 17.8.1 Proportion of individuals using the Internet technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology

#### **Capacity-building**

17.9 Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the Sustainable Development Goals, including through North-South, South-South and triangular cooperation

#### Trade

17.10 Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda

17.11 Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020

17.12 Realize timely implementation of duty-free and quota-free market access on a lasting basis for all least developed countries, consistent with World Trade Organization decisions, including by ensuring that preferential rules of origin applicable to imports from least developed countries are transparent and simple, and contribute to facilitating market access

#### Systemic issues

Policy and institutional coherence

<sup>5</sup> The current indicator 17.6.1 was previously listed as 17.6.2

17.6.1 Fixed Internet broadband subscriptions per 100 inhabitants, by speed5

to promote the development, transfer, dissemination and diffusion of environmentally sound technologies

17.9.1 Dollar value of financial and technical assistance (including through North-South, South-South and triangular cooperation) committed to developing countries

17.10.1 Worldwide weighted tariff-average

17.11.1 Developing countries' and least developed countries' share of global exports

17.12.1 Weighted average tariffs faced by developing countries, least developed countries and small island developing States

Goals and targets (from the 2030 Agenda for Sustainable Development)	Indicators
17.13 Enhance global macroeconomic stability, including through policy coordination and policy coherence	17.13.1 Macroeconomic Dashboard
17.14 Enhance policy coherence for sustainable development	17.14.1 Number of countries with mechanisms in place to enhance policy coherence of sustainable development
17.15 Respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development	17.15.1 Extent of use of country-owned results frameworks and planning tools by providers of development cooperation
Multi-stakeholder partnerships	
17.16 Enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries	17.16.1 Number of countries reporting progress in multi- stakeholder development effectiveness monitoring frameworks that support the achievement of the Sustainable Development Goals
17.17 Encourage and promote effective public, public- private and civil society partnerships, building on the experience and resourcing strategies of partnerships	17.17.1 Amount in United States dollars committed to public-private partnerships for infrastructure
Data, monitoring and accountability	
17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries	17.18.1 Statistical capacity indicator for Sustainable Development Goal monitoring
and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other	17.18.2 Number of countries that have national statistical legislation that complies with the Fundamental Principles of Official Statistics
characteristics relevant in national contexts	17.18.3 Number of countries with a national statistical plan that is fully funded and under implementation, by source of funding
17.19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical	17.19.1 Dollar value of all resources made available to strengthen statistical capacity in developing countries
capacity-building in developing countries	17.19.2 Proportion of countries that ( <i>a</i> ) have conducted at least one population and housing census in the last 10 years; and ( <i>b</i> ) have achieved 100 per cent birth registration and 80 per cent death registration



# CHAPTER 8

# Zero Waste Approach and Recycling

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## Introduction

The environmental problems threaten life as problems arising from factors such as unconscious use of resources, waste and pollution. The wasteful use of resources returns to the environment as waste materials, waste water and polluted air (Tseng et al., 2020). Plastic and electronic waste (e-waste) (Abalansa et al., 2021), microplastics causing bioaccumulation (Sol et al., 2020), excessive use of fossil fuels, deforestation and chemical pollutants (Choi et al., 2019) cause environmental problems in the form of water and air pollution, biodiversity loss and deforestation. Global climate change (Intergovernmental Panel on Climate Change (IPCC) [Intergovernmental Panel on Climate Change (IPCC)], 2018), which is one of the environmental problems with high sensitivity, is another main problem arising from these problems. All these negativities of anthropogenic nature are gradually surrounding us and bringing us closer to environmental bad scenarios that we think will never happen, but gradually we are being dragged step by step. The search for fast and effective solutions to these problems continues in different environmental ethical, rational, economic or oppositional variations. The zero waste approach is one of the perspectives adopted in reducing environmental problems, which is directly related to the problems and grounded in the logic of pollution, waste and recycling.

## Zero Waste Approach

The concept of zero waste (ZW) (Connett, 2013a), a pioneering and alternative solution to the waste problem in recent years, is the goal and policy of many fields. The concept of waste can be classified as municipal solid waste (MSW) such as household garbage and organic waste, industrial waste including industrial waste, mining waste and hazardous

waste including radioactive or electronic waste (Zaman, 2015) and waste is generated as a result of all human activities in life (Brunner & Rechberger, 2015). The basis of zero waste is the recovery of waste by abandoning the storage and incineration of waste (Zaman, 2015). Although waste is associated with leftovers and worthlessness after use in the ongoing history of the world, wastes are actually very important as they are our secondary carbon source (Lee et al., 2020). With zero waste, an energy recovery based on reduction, separation and utilization is realized. Zero waste is a key to tackling this crisis, as waste is growing like an avalanche due to human extravagance and waste (Foster, 2021). In the concept of zero waste, it is also planned to minimize consumption and thus prevent the generation of waste in the first place. March 30th has been declared as International Day of Zero Waste by the United Nations. With zero waste, zero environmental/economic/social loss is targeted.

### Figure 1. Zero Waste Concept



With the zero waste approach, waste prevention/proper management is carried out in a flow of preventing waste, using resources more effectively, reducing the amount of waste, collecting it in appropriate systems and using procedures to recover it in order to target zero waste. Its main objective is to reduce waste as much as possible before it goes to landfill and to conserve natural resources. This approach also prevents external dependence on fossil resources (Lee et al., 2020).

The benefits of the zero waste approach can be categorized under four main headings (Pietzsch et al., 2017):

1. Benefits for Society: Within the zero waste approach, there is an orientation for the public to implement this approach. This orientation indicates a positive effect on the attitude towards the environment. Consumption habits and the disposal/removal and collection of waste are tried to behave in accordance with the approach. This increases recycling and reduces risks to public health.

- 2. Economic and Financial Benefits: Profit increases in direct proportion to the decrease in waste with the zero waste approach. At the same time, environmental regulation costs and time wastage caused by waste are prevented with zero waste logic. Since recycling will occur naturally in zero waste, a profit is also made from these materials. Since zero waste will create new business areas, there is also an increase in income.
- 3. Environmental Benefits: The zero waste approach prevents waste generation and the damage it will cause. The lifespan of landfills is extended, productivity increases as waste will enter production processes as raw materials, and less raw materials are needed. Among the most important impacts of zero waste on the environment is the reduction in the emission of greenhouse gases. While energy is produced from waste, energy consumption is reduced thanks to ecoefficiency together with recycling processes. The zero waste approach ensures the protection of the environment and the reduction of the use of substances harmful to health.
- 4. Benefits for Industry and Stakeholders: Efficiency in the increase in energy and raw materials ensures maximum production with minimum resources, thus increasing the profit obtained. The make-use-dispose cycle for a product is abandoned and products with a longer life cycle are developed. The competitiveness of industry stakeholders increases and a sustainable way of sourcing products can be developed. Industrial symbiosis, the concept of companies in different industries sharing waste and side products with each other to increase resource efficiency and reduce environmental impact, is increasing.

The zero waste approach is closely associated with the economy in terms of its contribution to the economy and the financing of the approach. In particular, the approach is linked to the circular economy. This connection can be explained as zero waste production supports the circular economy, and the circular economy is attracting intense international attention (Kerdlap et al., 2019). The emergence of the circular economy is due to the fact that the linear economy, which made countries with a strong industry until the 20<sup>th</sup> century financially strong, ceased to function in the 21<sup>st</sup> century (Sariatli, 2017). Linear and circular economy models are shown in Figure 2 (Potting et al., 2017).



## Figure 2. Linear and Circular Economy

The "take-make-dispose" functioning of the linear economy has evolved into "reduce, reuse and recycle" in the circular economy. Therefore, the circular economy aims to eliminate waste and pollution caused by waste by keeping products and their components in long-term use. In the circular economy, recycling (transforming waste into products/materials for reuse), repair (fixing defects in the functioning/use of products to extend their lifespan), reuse and upcycling (transforming waste into products that are more valuable in material terms) are applied towards zero waste (Ministry of Environment, Urbanization and Climate Change, 2019a).

## Zero waste management

Under the influence of circular economy in zero waste management, many rules or hierarchical order are applied and expressed by "R". In the study, 3Rs, 5Rs and 9Rs will be mentioned in chronological order.

## The 3Rs of zero waste

The 3R rule, also known as the Waste Hierarchy (Whitmarsh et al., 2018), is the most basic zero waste cycle. The acronym with the Reduce-Reuse-Recycle flow is a minimized path to follow in the zero waste process. Reduce means to first reduce the use of resources in production/consumption; Reuse means to reuse to reduce the amount of waste; Recycle means to return to nature. An illustrative visual for the 3R's rule is presented in Figure 3.


**Figure 3.** *The 3Rs of Zero Waste* 



# 5Rs of zero waste

The 5R rule is a complex flow of additions to the 3R rule's steps. It is widely adopted and provides guidance in transforming zero waste into a lifestyle. The 5R acronym stands for Refuse-Reduce-Reuse-Recycle-Rot flow. Refuse refers to consumption habits, considering the need for a product/material before purchasing it and refusing to consume it if it is unnecessary. Reduce is the simplification of life and reduction of waste. Reuse is avoiding single-use products and opting for long-lasting products. Recycling is the need to consider the possibility of recycling if the R's in the first three steps cannot be met. Rot is the composting of organic waste (Johnson, 2013). An explanatory visual for the 5R rule is presented in Figure 4.

5Rs of Zero Waste



#### 9Rs of zero waste

The fact that the 3Rs, the basic hierarchy in which zero waste is implemented as a progressive system, has been expanded to 5Rs shows that the 5Rs can also be expanded. One of these is 9R and 9R is also related to the circular economy model. In the 9R, there may be differences in the number and steps (Kirchherr et al., 2017; Potting et al., 2017; Van Buren et al., 2016). An explanation of the 9R framework is presented in Figure 5 (Kirchherr et al., 2017; Potting et al., 2017; Figure 5.

9Rs of Zero Waste



# History of Zero Waste Approach

It is considered that a general overview of the chronology of the zero waste approach may be useful in providing clarity. The idea that waste can be a resource that can be reused dates back to the 19<sup>th</sup> century (Bilgili, 2021). It is quite difficult to obtain precise information on how long the term zero waste has been used. According to Murray (2002), the term zero waste comes from Japanese Total Quality Management (TQM). The term zero waste was first used in 1973 by the American chemist Palmer when he founded ZeroWaste Systems Inc. In ZeroWaste Systems Inc, where the term was used in the public sphere, chemical products that were removed because they would not be reused were reused as raw materials. The organization was successful for the ten years it was in operation. In the late 20<sup>th</sup> century, the term was adopted by activists and began to be used widely (Warner et al., 2015).

The National Recycling Coalition (NRC) was founded in 1978 with the aim of bringing companies, managers and interested communities together to recycle solid waste (Rootes & Leonard, 2009). In the early 1980s, in the United States of America (USA), the effects of the habit of incinerating garbage on the environment and the health of people, an important part of the environment, were discovered and counter-actions were taken and a great impact was achieved on the way to zero waste approach (Bilgili,

2021). During the 1980s, Daniel Knapp developed the Total Recycling Concept (Connett, 2013b), which concretized that garbage collected in Urban Ore with the idea that it could only be incinerated could be reused.

Having developed the Total Recycling concept in the 1990s, Knapp expanded it abroad and became a major activist for the "Zero Waste No Waste" lifestyle. Assisted by an international network of people involved in zero waste in 1995, Lynn Landes initiated efforts to inform the public about environmentally friendly waste management. In the same year, the Grassroots Recycling Network (GRRN) was founded by the California Resource Recovery Association, the Institute for Local Self-Reliance, and members of the Sierra Club's Waste Committee to take recycling one step further through education, collaboration and support. This organization became the pioneer of zero waste based practices in the USA (Izeman & Gokaldas, 2004). A major step towards zero waste was taken at the city level in Canberra, the capital of Australia, in 1996. The organization, sloganized as "No Waste By 2010" (Silva et al. 2016), became a milestone in the zero waste approach, with some municipalities in New Zealand and San Francisco adopting zero waste and other cities joining them.

The first significant zero waste milestone of the 2000s was the proposal of the Zero Waste International Alliance (ZWIA). The alliance, held its first official meeting in 2003 due to financial difficulties, has been working on zero waste and continues its activities for a waste-free world with The Eleventh Zero Waste Dialogue in 2022 (ZWIA, 2023).

As a requirement in the 2010s, the zero waste approach has become fashionable and started to be adopted as a lifestyle. It is aimed to internalize the practices and simple rules for the collection and separation of waste at the household level in architecture. Nowadays, the view that the future of the world can be shaped by choosing zero waste products is dominant. Johnson (2013) states that with simple rules, one year of nonrecyclable waste produced by a family of four can be as much as a mason jar, and the popularity of this practice is increasing. On the other hand, zero waste activists agree that people gaining this habit and living their lives with zero waste awareness will have a positive impact on our common future (Müller & Schönbauer, 2020).

# Fundamentals of Zero Waste Approach

Since the zero waste approach is an environmental protection-based approach that has found a place in many fields, many studies have been conducted in the literature. The zero waste approach has organic links with sustainable development, recycling and environmental awareness.

# Zero waste approach and sustainable development

The formation of the sustainable development concept began in the 1970s and 1980s when people realized that their unconscious use of the environment and resources threatened

their lives (Bogutz et al., 2021). The idea of sustainable development was formed in the 1980s based on the development of economy, society and environment by supporting each other. The sustainable development concept was defined by The World Commission on Environment and Development (WCED) in the "Our Common Future" report published in 1987 as the use of today's resources with future generations in mind. Equality between generations is considered. Currently, it has become an important variable in the management policies of states and companies at the international level (Shi et al., 2019). The implementation of sustainable development varies depending on who implements it. The sustainable development process, progressing subjectively rather than objectively, may vary depending on the size of the mass/region, where this mass/region is located in the world and the sector (Jiménez-Martínez & García-Barrios, 2020). Sustainable development consists of three dimensions as economic, social and environmental, and achieving sustainability is based on achieving all dimensions simultaneously (Wu, 2013). According to the positioning and relationships of these dimensions within the system, weak and strong sustainability models are formed (Neumayer, 2003) and an explanatory visual of these models is presented in Figure 6 (Wilson & Wu, 2017): Figure 6.

Sustainable Development Models



The weakness or strength of the sustainable development model is determined by the discussion within its economic dimension (Bilgili, 2017). Weak sustainability is a human-centered model that thinks that the decrease in the value of environmental elements in the system can be replaced by the economic dimension. According to the model, environmental losses that are accepted from the beginning can be balanced with economic gains and there can be a payback. Strong sustainable development, on the other hand, defends the idea that the environmental dimension is complementary to other dimensions and states that environmental losses cannot be compensated or replaced. At this point, it is understood that strong sustainability is opposed to weak sustainability. In both weak and strong sustainability, the zero waste approach is important. The raw material and financial contribution of sustainable development in the economic dimension, the conservation of natural resources in the environmental dimension and the ideal of leaving a better environment to future generations, and the fair sharing of welfare in the social dimension can be strengthened by the catalyzing effect of the zero waste approach. Current Studies in Environmental Education

Specific paths have been drawn for the realization of sustainable development, which strives to provide a sustainable system structure for our planet. For this purpose, 17 Sustainable Development Goals (SDGs) were set by the United Nations (UN) and its member states in 2015 (Halkos & Gkampoura, 2021). These goals serve as a guide on the journey to achieve sustainable development by 2030. UN Turkey and its partners are working to achieve these goals. These goals are presented in Figure 7 (UN, 2015):

# Figure 7.

The Seventeen Sustainable Development Goals



The most relevant sustainable development goals for the zero waste approach are the following:

- SDG 6 (Clean Water and Sanitation) is linked to the zero waste approach through its target of eliminating littering in water by 2030.
- SDG 7 (Affordable and Clean Energy) is linked to the zero waste approach through its content on global energy efficiency by 2030.
- SDG 8 (Decent Work and Economic Growth) is linked to the zero waste approach with its content on economic efficiency, global resource efficiency in consumption and production, and preventing the negative impact of economic development on the environment by 2030.
- SDG 12 (Responsible Consumption and Production) is linked to the zero waste approach with its content on sustainability of natural resources, reducing global food waste, considering the health of the environment in the life cycle of all wastes and their proper disposal, reducing the amount of waste through prevention, reduction, recycling and reuse in accordance with the zero waste approach flow, and living in harmony with nature by 2030.
- SDG 15 (Life on Land) is linked to the zero waste approach through its content on creating a neutral world, protecting biodiversity and ecosystems and preventing degradation by 2030.

Sustainable development is directly included among the specific objectives of

the Turkish science curriculum (Ministry of National Education [MoNE], 2018). The reflections of this aim are seen in the learning outcomes. Activities related to waste hierarchy and zero waste are reflected in textbooks.

#### Zero waste and environmental awareness

As with the zero waste approach, environmental awareness has a direct relationship with environmental problems. Growth and developments in the economic field have led to overuse of the ecosystem, and while the growth of the global economy has increased rapidly, the world ecosystem has deteriorated at the same rate (Jackson, 2009), resulting in environmental problems. Environmental education mobilizes individuals and raises awareness to solve environmental problems such as waste (Lai, 2018). Environmental education aims to develop knowledge, attitudes and behaviors towards the environment (Ardoin et al., 2015), as well as achievements related to the world (Vasconcelos & Calheiros, 2022). The point that environmental education aims to reach individuals is environmental awareness (Erten, 2019). An environmentally conscious individual is also an environmentally friendly individual, and the process of raising awareness of this individual proceeds in the flow in Figure 8 (Candan-Helvacı & Erten, 2022): Figure 8.

Environmental Awareness Path



Adopting a zero waste approach as a way of life follows the same path. Cognitive processes such as knowing the zero waste approach and its positive effects on the

environment are within the scope of environmental knowledge. Affective acquisitions such as liking this approach after acquiring knowledge about zero waste and the tendency to ritualize it out of concern for the future of the environment are related to positive attitudes towards the environment. Actions such as categorizing waste and throwing it into appropriate waste bins, applying the 3R, 5R and 9R processes are useful behaviors. At this point, it is seen that environmental awareness is the enabler of the realization of the zero waste approach. Education is at the top of the hierarchy put forward in the researches on transforming zero waste into a way of life and establishing zero waste cities. It is known that environmental awareness is important for zero waste to achieve its goals (Zaman & Lehmann, 2013).

# Zero waste approach and recycling

Over one billion tons of solid waste is generated anthropogenically in the world annually, and this waste is dispersed into the environment, causing social, economic and environmental problems (Sharma & Garg, 2019). Zero waste and recycling, attempting to tackle this problem, are associated with realizing the goal of a sustainable world. Looking at the waste management approaches adopted in zero waste (such as 3Rs, 5Rs and 9Rs), it is seen that recycling is included as a step in all of them, that is, recycling is an element of the zero waste approach. The belief that recycling is the right thing to do and has a positive impact on the environment saves energy and materials by making waste reusable (Ackerman, 1997). By reducing waste through recycling, the zero waste approach and sustainable development are served. Waste types in the zero waste approach are as follows Ministry of Environment, Urbanization and Climate Change, 2019b): **Figure 9.** *Waste Types* 



There are two different trends in recycling: Upcycle and Downcycle. To recycle some waste means using more energy and can be reused to make it more valuable (Oyenuga & Bhamidimarri, 2017). Upcycle is the transformation of waste material into a more valuable product. The fact that waste material loses its value/quality when recycled

(Bursaligil, 2019) and can be recycled until it loses its value/quality is called downcycle. The transformation of paper is an example of this.

Recycling is an opportunity for waste to be "reborn". The way the circular economy works, waste should be in the cycle for as long as possible. By recycling, waste does not have a single life cycle. The number of times materials of some recyclable waste types can be recycled, namely the number of life cycles, is as follows (Table 1):

Waste Type	The Number of Life Cycles
Plastic	Theoretically, all plastics can be recycled, but this is an inefficient and costly process. Depending on the plastic resin identification code, plastics can be recycled mechanically 3-7 times (Reed & Chen, 2022).
Glass	They can be recycled unlimited times (Robert et al., 2021).
Paper	They can be recycled a maximum of 6-7 times (Villanueva & Wenzel, 2007).
Metal	They can be recycled almost infinitely. Examples include aluminum (Brough & Jouhara, 2020) and steel (Yellishetty et al., 2011).
Composite Waste	They can be recycled 5 times (Hamad et al., 2013).

**Table 1.**Number of Recyclable Wastes Recycled

The efficiency of recycling, an important step in waste management, is related to the effective use of waste bins. Depending on the type of waste, there may be slight differences between countries in determining the color of the recycling bin or the number of waste classifications. The colors of waste bins in Turkey were standardized by the Zero Waste Regulation published by the Ministry of Environment and Urbanization (the name of the Ministry was changed to the Ministry of Environment, Urbanization and Climate Change) (2019c). Accordingly, the colors of waste bins are as follows:

- Blue color if paper, glass, metal, plastic waste is collected together, dark gray for other waste,
- Blue for paper waste, yellow for plastic waste, green for glass waste, and light gray for metal waste, if they are to be disposed of in separate waste bins,
- The color brown is used in places that provide/serve food where biodegradable waste is high and collected separately.

# Conclusion

Along with metropolises, other cities around the world are now growing rapidly and consuming the resources of the ecosystem. Until very recently, unconscious consumption was followed by a huge garbage problem. It was thought that this could be dealt with by burning it, throwing it out of sight or dumping it in the sea. Following the shift from a linear economy, contributing significantly to pollution, to a circular economy and the realization that the environment needs protection, new concepts have entered our lives. Zero waste approach, recycling and sustainable development are important variables that support each other and intersect at certain points in solving the waste problem. Reducing the amount of waste is important in the zero waste approach and thus environmental pollution can be prevented. Recycling ensures efficient use of energy and resources. The combination of recycling and the zero waste approach, as a concept that encompasses it, reflects positively on the welfare level of the society as well as environmental and economic returns. Since environmental, economic and social impacts directly point to sustainable development.

The adoption of the zero waste approach as a way of life and the realization of the efficient functioning of recycling are clearly seen to be possible through environmental education and the acquisition of environmental awareness. The path of knowledge-attitude-behavior should be completed for the zero waste approach and other accompanying concepts through the development/change of environmental awareness. The zero waste approach, perceived as a waste collection task, should be put into action by leaving aside the lifestyle in which individual tasks are not completed for sustainable development and the reductionist perspective towards recycling.

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# Sustainable Development and Environmental Literacy

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# Sustainable Development

Environment is a whole of interactions in nature (Buckingham & Turner, 2008). Environment is the environment where all living and non-living things live together in a balance that needs to be protected (Erten, 2012). With the existence of human beings on earth, they started to live in a relationship with their environment. The relationship between human and environment has continued in various ways from ancient times to this day. Human beings have lived all their individual and social life in relationship with their environment from the time they first existed on earth until today. While this relationship was initially in the form of meeting the needs necessary for survival from the environment, it has continued in different ways as needs, expectations and desires have changed over time. In the early times, the strong and superior party in this relationship was the environment. Human beings are aware that they need the environment. In this context, he accepted the superiority of the environment. However, from past to present, this acceptance has been replaced by an effort to establish dominance. Over time, living conditions, needs and desires have changed, and as a result of this change, man has shown a desire to dominate nature, that is, his environment. As a result of this situation, he tended to use his environment more (Hughes, 2016).

From the beginning of history to the present day, human beings and the environment have been two elements that cannot be separated from each other. Human beings have sustained their existence through a close relationship with their environment. Human beings have been affected by the environment throughout their lives and have affected their environment with their activities. While this interaction was in the form of meeting the compulsory needs such as shelter and nutrition required for human survival from the environment in the early times, over time this relationship has turned into a relationship in which humans harm the environment (Khagram at al., 2010). Changing living standards of individuals, competition between individuals and societies, and rapid industrialization steps taken without fully considering the consequences have contributed to the destructive effect of this relationship (Li, 2018). With the change of the era, the advancement of time, the changing needs and expectations of individuals and the increase in the population, especially in the process that started with the industrial revolution, the impact of human beings on the environment has become destructive and this situation has made it necessary to bring the issue of environmental protection to the agenda at the global level (Mensah & Casadevall, 2019).

The current environmental destruction has reached serious levels when urbanization and population growth are added to the negative effects of the steps and practices taken by societies without thinking about the future for the purpose of industrialization. The high levels of environmental destruction have supported the idea that intervention is now necessary. Although many environmental problems brought about by environmental destruction initially existed regionally, it was understood that the effects of these problems would be felt throughout the world over time. Thus, societies realized that regional solutions were short-term and temporary solutions and started to look for solutions to problems on a global scale (Liu at al., 2018). In particular, with the mechanization process that started with the industrial revolution, a large number of people who believed that they would have better job and living opportunities migrated from their villages to cities, increasing and accelerating this migration system that has always existed. Due to this situation, serious population growth has started to be experienced in cities. With this migration movement, the need for nutrition and shelter of the increasing population in cities has also increased. Depending on the housing needs of the increasing population, cities have started to grow as settlement areas. This situation has led to an increase in the use of fossil fuels, reduction and destruction of agricultural areas, forests and green areas (Okumuş & Okur Akçay, 2020).

In the current century, the environmental destruction caused by unconscious steps taken with the impact of industrialization, urbanization and rapid population growth has reached high levels, bringing with it concerns about human health and the future of the planet. As a result of the destruction of natural life and the unconscious use of resources, many deadly problems such as hunger, disease and poverty have started to emerge in some parts of the world in connection with food and water shortages. In addition to these, changes in the climate, destruction of the ozone layer and global warming have begun to threaten the world's present and future. When it was realized that the Earth would lose its status as a habitable planet if this trend continued, solutions began to be



Before moving on to the definitions of sustainable development, the concepts of "sustainability" and "development" should be mentioned separately. It is known that the concept of sustainability first appeared in the "World Charter for Nature" adopted by the World Union for Conservation of Nature (IUCN) in 1982. The concept of sustainability is a word that is used in many fields and disciplines today and expresses the capacity for continuity and a certain process. In the World Charter for Nature, the concept of sustainability means ensuring the continuity of the organisms, environment, atmosphere, land and water resources that individuals benefit from during their lives in a way that does not harm the ecosystem (McNeely & Miller, 1983). The concept of development, on the other hand, refers to the attempts made to make individuals or societies better than their current situation. The concept of development is a broad concept that covers all the efforts made for the positive development of the economic, social and cultural structure of societies (Neumayer, 2012).

Since sustainable development is used by many different sciences and disciplines, there are different definitions in the literature. The concept of sustainable development has been interpreted in different ways by many different audiences such as disciplines, governments, businesses and environmentalists due to its broad scope of meaning and the fact that it is a field that depends on many different factors (Giddings at al., 2002). Many definitions of sustainable development have been made over time and have been accepted by certain circles. Among these definitions, the one that is still valid today is the definition made by the World Commission on Environment and Development (WCED). In 1987, the World Commission on Environment and Development (WCED) defined the term sustainable development in the report entitled "Our Common Future", also known as the Brundtland Report, named after Gro Harlem Brundtland, Prime Minister of Norway at the time. In the relevant document, sustainable development is defined as meeting the needs and requirements of the present in a way that does not eliminate the capacity of future generations to meet their needs (WCED, 1987).

Another widely accepted definition of sustainable development is that of the United Nations Environment Program (UNEP). UNEP defines the concept of sustainable development as the realization of practices aimed at improving living standards in a way that does not adversely affect natural life and systems. Another definition of sustainable

development belongs to the International Union for Conservation of Nature and Wildlife (IUCN). The International Union for Conservation of Nature and Natural Resources defines sustainable development as a term that means respecting nature while meeting the needs of individuals and not taking more than the planet's capacity to renew itself. When the literature is examined, it is seen that there are different definitions made by different commissions and organizations. The common point of these definitions is that the concept of sustainable development does not refer to development in a single field. Although sustainable development represents a multidimensional structure, if it is desired to be explained in the simplest way, it refers to the continuity of developments and changes in the elements of economy, environment and social life in relation to each other (Sachs, 2012).

#### Sustainable Development from Past to Present

As time progresses, the effects of changing living conditions on natural life and the environment have not been positive. Especially with the effect of rapid population growth with the industrial revolution, individuals used nature as if it were an unlimited resource. During and after this period, the long-term effects of many steps taken by individuals in the name of industrialization on the environment were not considered and short-term economic profit was focused on. Unconscious use of natural resources, rapid population growth, wrong production and economic policies have caused the natural balance to deteriorate. The negative impact of these destructive human behaviors on the environment has started to be felt over time. As a result of these environmentally unfriendly behaviors, many problems such as environmental pollution, difficulty in providing clean water, famine, hunger, global warming, ozone layer destruction, destruction of habitats, extinction of some species, extreme weather events have emerged and reached serious dimensions. The negative effects of these problems have increased over time and evolved into global problems that threaten humanity and the planet. It has been realized that environmental problems, which initially emerged regionally, will become global problems over time. The increasing severity of environmental problems and their consequences has caused concern for the future (Fischer at al., 2012). With the increase in environmental concerns, solutions have been sought at the global level. The acceleration of the process of our planet becoming an unfavorable environment for the continuation of human life has necessitated intergovernmental cooperation. When it was realized that environmental problems could not be prevented by individual or regional efforts and that governmental and societal action was necessary, the search for international solutions to this issue began. One of the comprehensive concepts put forward as a solution proposal in this search process has been the concept of sustainable development. The emergence and acceptance of the concept of sustainable development is based on the idea that development initiatives in environmental, social and economic dimensions should be continuous and in the interaction of these three dimensions. Based on this idea, improvement practices have been worked on, targets have been set, reports have been presented and international agreements have been signed (Emas, 2015; McNeill, 2004).

Sustainable development as an idea is actually a proposed solution to end the situation in which our planet is no longer able to offer a healthy future. The concept of sustainable development has been identified and accepted as a solution to increasing environmental and health problems, as well as increasing economic concerns and distrust in the justice system, decreasing people's confidence in a healthy future, and ending the trend of our planet becoming an unfavorable environment for the continuation of living species (Hopwood at al., 2005).

The first indication that sustainable development is a necessity and a need is seen in the book "Silent Spring" written by Rachel Carson in 1962. In this book titled Silent Spring, it is stated that humans are destroying nature day by day and it is emphasized that if this situation continues, natural resources will become unusable. In the book, the researcher predicted that if this negative situation continues, our resources will run out and our planet will become an unfavorable environment for living life (Keitsch, 2012). The foundations of sustainable development on the basis of international cooperation were laid at the United Nations (UN) Stockholm Conference in 1972. At the conference, which was held with the participation of many developing and industrializing countries, it was emphasized that living in a healthy and sustainable environment is the right of all individuals. The conference emphasized the importance and necessity of international action and cooperation for the protection of the environment. At the end of the conference, the Stockholm Declaration consisting of 29 articles was published. With this declaration, the foundations of environmental cooperation were laid on an international platform. The UN Stockholm Conference is the first conference to address the concept of environmental protection on the international platform with the participation of different states. Although the term sustainable development was not officially included in the conference, the sharing of environmental concerns and worries on a global platform and the search for solutions to these problems in cooperation formed the basis of the concept of sustainable development (Handl, 2012). In the same year, a report entitled "The Limits to Growth" was published by a strategy development center called the Club of Rome. The report emphasized the impossibility of unlimited growth with limited resources and highlighted the negative consequences that would occur if global problems continued at this rate. The predictions of this report on development and the environment have reverberated around the world. The report is one of the first studies to examine the interaction between the environment and world economic policies. The report is also known as the building block of the green economy approach. In the report titled Limits to Growth, the emphasis that the relationship between environment and economy should be included in development plans and strategies is interpreted as an emphasis on

the necessity of sustainable development policies, even though it is not included as a concept (Nørgaard et al., 2010).

The first organization to address the concept of Sustainable Development on a legal platform was the World Commission on Environment and Development (WCED) established by the UN General Assembly in 1983. In the report titled "Our Common Future" published by the Commission in 1987, the definition of the concept of sustainable development was included. In this report, sustainable development is defined as "meeting the needs of the present in a way that does not jeopardize meeting the needs of future generations". The report mentions four basic steps of sustainable development. These steps are listed as future generations, basic needs, resources and poverty reduction and prevention. With this report, also known as the Brundtland report, it is emphasized that it is important and necessary to ensure its continuity as well as production and management in various issues ranging from environmental concerns and concerns, social and social themes, economic policies and management strategies. The report includes the principles that a sustainable development approach should adopt. These principles are;

- Ensuring that growth is active and qualified,
- Providing basic needs such as employment, shelter, health, water, food and energy,
- To ensure that population density is kept at a sustainable level,
- Ensure the protection and enrichment of natural resources,
- Ensure risk management,
- Ensuring that technology is driven,
- Ensuring the integration and consideration of the relationship between environment and technology in decision-making processes, are listed as (Holden at al., 2014; UN, 1987).

The Brundtland Report contains the principles of sustainable development and the arrangements to be made to realize these principles. The report is the first in terms of addressing sustainable development on an official platform for the first time. A management system that effectively involves individuals in the decision-making process, a sustainable, safe, productive and technical economic system, a social system that can solve problems arising from unsustainable development initiatives, production policies that respect the ecological system, a continuously developing technological system, an administrative system that can remain flexible and up-to-date, and finally an international system that encourages and supports sustainable economic and trade policies are among the arrangements included in this report for the realization of sustainable development principles (Brundtland, 1987; Brundtland, 1989).

The next step in the international discussion of sustainable development was the



United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil in 1992. 178 countries participated in the conference. The United Nations Conference on Environment and Development (UNCED) is also known as the "Rio Conference", "World Summit" and "Earth Summit" in the literature. This conference was held on the 20th anniversary of the Stockholm Conference and the aim of the conference was to evaluate the 20-year process and to produce solution strategies for current problems. The conference emphasized the importance of social sustainability, which is one of the main components of sustainable development. The Conference emphasized the necessity of shaping legal regulations and economic policies according to the principles of sustainable development. As a result of the conference, 5 documents were published. These are Rio Declaration, Agenda 21, Convention on Biological Diversity, Forest Principles and Climate Change Convention. Of these documents, Agenda 21 and the Rio Declaration are particularly related to sustainable development. Agenda 21 is also known as the "21st Century Agenda". This document aims to examine the interaction between development policies and environmental policies and to ensure that the environmental problems that exist today are not carried into the future. This document is an action plan for sustainable development. The Rio Declaration provides a general perspective for sustainable development. In this document, the interaction between human and environmental rights is emphasized and the duties and responsibilities of governments on these issues are included (Sneddon at al., 2006; Weiss, 1992). The Kyoto Protocol is one of the implementation instruments of the UN Framework Convention on Climate Change, one of the five declarations issued as a result of the Rio Conference. The Protocol was signed in Kyoto in 1997. The aim of the Protocol is to reduce the anthropogenic greenhouse effect by controlling greenhouse gas emissions and to protect our planet against the negative effects of two global disasters, namely increasing global warming and climate change. The Kyoto Protocol is one of the leading steps taken to prevent the greenhouse effect and global warming. Although this protocol is not directly related to sustainable development, it is also important for the sustainable development process as it is one of the most important agreements made to ensure the sustainability of the planet (Maamoun, 2019).

The next step was the World Summit 2, which took place in 1997 at the United Nations General Assembly with the participation of 165 countries. This summit is also known as the Rio+5 Summit. The purpose of this summit was to evaluate the 5-year process after the Rio Conference. The purpose of the World Summit 2 is to evaluate and discuss the extent to which the decisions taken at the Rio Conference have been implemented, how useful they have been and the current status of the steps taken for sustainable development. In this conference, in which the extent to which the goals discussed in the Rio Conference were realized, the reasons for this failure and preventive measures were discussed, it was concluded that there was a slight improvement in developed countries, but the problems continued in underdeveloped and developing countries, the improvement required by the decisions taken as a result of the Rio Conference was not realized, and it was emphasized that more concrete steps should be taken to achieve the principles and principles of sustainable development (Ayre & Callway, 2013).

The next international step in sustainable development was the United Nations Millennium Development Summit held in New York in 2000 under the leadership of then UN Secretary General Kofi Annan. Organized with the participation of 189 countries, this summit is also known as the "Millennium Summit". At this summit, 8 "Millennium Development Goals" planned to be realized until 2015 were determined. These 8 goals put forward as a result of the summit are very important in terms of determining the main dimensions of the understanding of sustainable development. The 8 goals called the Millennium Development Goals;

- Minimizing hunger and poverty globally,
- Ensuring the right to basic education for all individuals,
- Ensuring that women's status in society is enhanced by ending gender discrimination,
- Prevent child mortality and reduce the global child mortality rate to the lowest level,
- Implementation of efforts to improve maternal health,
- To carry out efforts to combat and prevent epidemics,
- Ensuring environmental sustainability,
- Collaborating with governments at the global level for development (Lomazzi at al., 2014).

A report called the Millennium Development Report was published in 2015 to assess how successful the goals have been in the 15-year period that began with the setting of the Millennium Development Goals. According to the Millennium Development Report, in this 15-year period, there has been a decrease in the number of poor individuals worldwide (from 1.9 billion to 836 million), a decrease in the number of individuals who cannot receive basic education (from 100 million to 57 million), a decrease in the number of child deaths, a 45% decrease in maternal mortality, a decrease in malaria-related deaths (6.2 million people were saved from death and treated), and an increase in the number of individuals with a daily income of 4 dollars or more (approximately tripled). According to this report, 2.6 billion people were provided with drinking water during this period. While the statistics in the published report point to some improvements, at the global level this is not enough. Too many individuals still struggle with hunger, poverty, access to clean water and epidemics. Even if the rates are decreasing, there are still high rates



of child mortality and maternal mortality. In 2015, the "2030 Agenda for Sustainable Development Goals" was published as a continuation of the Millennium Development Plan after it was determined that the Millennium Development Goals could not be achieved with full efficiency (Diaz-Sarachaga at al., 2018; Halisçelik & Soytaş, 2019).

The next stop in the historical journey of sustainable development was the United Nations Johannesburg Summit (World Summit on Sustainable Development) (Rio+10), which took place in 2002 with the participation of 104 countries, private sector and non-governmental organizations. The purpose of this summit was to evaluate the process from the Rio Conference in 1992 until 2002. At the summit, the achievement of the goals set 10 years ago at the Rio Conference was analyzed and the necessary implementations were determined and planned. The Johannesburg Declaration and the Johannesburg Implementation Plan were published as a result of this summit. The implementation plan includes targets to be achieved by various years. The fact that not only state leaders but also non-governmental organizations and private sectors took part in this conference is very important in terms of the adoption of the understanding of sustainable development by all circles. In this context, it was emphasized that sustainable development is a global responsibility (Von Frantzius, 2004).

The United Nations Summit on Sustainable Development (Rio+20) held in Rio de Janeiro, Brazil in 2012, 10 years after this conference, is the next stop in the historical process of Sustainable Development. In this conference, the status of achieving the sustainable development goals and targets of the previous conferences was discussed and global cooperation was called for in this process. Appropriate planning was made by determining what needs to be done to achieve the goals and the strategies that are missing or faulty in the process of preventing environmental problems. At the end of the conference, a declaration entitled "Future We Want" was published. The declaration consists of 283 articles prepared under the themes of political determination, our common vision, green economy for the prevention of poverty and hunger in the process of sustainable development, theoretical framework of sustainable development, implementation framework of sustainable development and implementation methods. This declaration is very important in the sense that its articles are directly based on the understanding of sustainable development. This declaration, called The Future We Want, is a guide in terms of specifying what needs to be done for the future of a society that has adopted a sustainable development approach. The emphasis on sustainable development is clearly seen in all the articles in the declaration (Bartelmus, 2013; Nhamo, 2014).

The next important international conference in the historical period of sustainable development is the United Nations Summit on Sustainable Development, which took place in New York in 2015 with the participation of 193 countries. In 2000, the Millennium Development Summit resulted in a significant achievement of the goals set, but this achievement was insufficient in solving or preventing problems at the global level.

Published in 2015, the Human Development Index data proves this situation. Human Development Index data show that the Millennium Development Goals have been a serious success from 2000 to 2015, but when the performance in terms of achieving the goals is evaluated on a global scale, it is understood that it is insufficient to bring the expected solutions to the economic, social and environmental problems it faces. For this reason, the Summit emphasized the necessity of setting sustainable development goals that are inclusive and provide solutions to the current problems of our world in the light of the experiences gained from the sustainable development process initiated with the Millennium Development Goals. In this summit, the reasons for the partial failure of the goals published in 2000 were discussed and efforts were made to achieve global success. In this context, as a result of the summit, the 2030 Sustainable Development Goals (SDG 2030) were set under the name "Transforming our world: the 2030 Agenda for Sustainable Development". Adopted with the signatures of 193 countries, SDG 2030 consists of 17 core goals. These 17 goals were developed to compensate for the failure of the Millennium Development Goals, and when these goals are analyzed, it is seen that a balanced and indivisible emphasis is placed on the three basic dimensions of sustainable development: environment, society and economy, and a more holistic approach is displayed. This global agenda envisages that by 2030, countries should shape their development plans and strategies in the context of these goals. With the goals and targets set, the world has been informed of the determination to promote practices in areas of critical importance for the planet and humanity by 2030. What is meant by these areas are the factors necessary for people to live in a peaceful, equal, healthy and prosperous world and to have a healthy and sustainable environment. These 17 themes are presented below (Assembly, 2015; Pedersen, 2018; Zimon at al., 2000).

- Goal 1. To end all forms of poverty wherever it exists
- Goal 2. End world hunger, promote sustainable agricultural practices, ensure food security and good nutrition
- Goal 3. To ensure that individuals in all age groups have a healthy life and to encourage individuals to live a well-being life
- Goal 4. Providing inclusive, equitable, quality education and lifelong learning opportunities for all individuals
- Goal 5. Achieving gender equality, strengthening and supporting the position of women and girls in society
- Goal 6. Ensuring access to clean water for all individuals and supporting sustainable water management
- Goal 7. Ensuring that all individuals have access to affordable, sustainable, reliable and modern energy systems

- Goal 8. Promote decent work, full and productive employment and a sustainably developing economy for all individuals
- Goal 9. Promoting innovation, building resilient and robust infrastructure, and supporting inclusive and sustainable industrialization
- Goal 10. Preventing national and international inequality across the globe
- Goal 11. Transforming settlements into robust, inclusive, sustainable and safe areas
- Goal 12. Ensuring sustainability in production and consumption policies
- Goal 13. Ensuring cooperation to combat global climate change and its negative consequences
- Goal 14. Ensuring the conservation and sustainable use of the resources of the oceans and seas for sustainable development
- Goal 15. Protecting all ecosystems and forests, making improvement arrangements, ensuring sustainable management, preventing desertification, land degradation and loss of biodiversity,
- Goal 16. Building inclusive and peaceful societies for sustainable development, ensuring justice, and supporting transparent, inclusive and effective institutions
- Goal 17. Promote global cooperation for sustainable development and keep implementation tools up to date (Vinuesa at al, 2020).

As is evident in the historical journey of the concept of Sustainable Development, this concept is possible by ensuring the continuity of social, environmental and economic sustainability at the same time and in a balanced manner. In the light of this information, the concept of sustainable development has taken the form adopted today. This three-element balance model is known as the "Three Pillars - People, Planet, Profit" and the "Three E's Balance Rule - Environment, Ecology, Equity/Equality and Economy/ Employment" (Figure 1).

# Figure 1.

Three Pillars Model



According to this balance model, sustainable development has three main dimensions: society, environment and economy. Sustainability in each of these dimensions should be achieved simultaneously. The area where these three main dimensions intersect is the area where sustainable development is realized (Dalampira & Nastis, 2020; Flint, 2013).

#### Main Components of Sustainable Development

The understanding of sustainable development has three basic dimensions: society, economy and environment. The area where sustainability in these dimensions intersect expresses the understanding of Sustainable Development. In the understanding of sustainable development, the dimensions of social/societal sustainability, environmental sustainability and economic sustainability are in a simultaneous and balanced continuity.

#### 1. Sustainable Economy

In traditional, classical economics, what is important is the market's ability to allocate resources efficiently, so resource depletion is ignored. At this point, it is not usual for environmental concerns to be included in the classical understanding of economics. In contrast to this understanding, resource depletion is an important issue for the economy in sustainable systems (Goodland, 2002).

All over the world, especially after the industrial revolution, the environment and natural resources have been used excessively and unconsciously to ensure economic growth and development. This use has led to an increase in the rate of depletion of resources and the inability to renew them, bringing with it a lot of serious pollution and health problems. So much so that these problems have become so risky that they threaten humanity and our planet. In this context, in order to solve this problem, international studies and collaborations have been initiated for the global acceptance of environmentally friendly economic systems by abandoning classical traditional economic methods. With these developments, it is aimed to take measures and find solutions for existing problems. As a result of these studies, the concept of sustainable economy has been adopted with the emergence of the concept of sustainable development. In contrast to the classical, traditional understanding of economy, what is meant by sustainable economy is an understanding of economy that has longer-term, global goals and is environmentally oriented (Barrier, 2017). The depletion of resources is one of the most important issues for a sustainable economy. Due to this possibility, sustainable economic systems support renewable natural resources as resources and build the economic system around these resources. Activities such as recycling the energy and materials used and bringing them back into the system, using less raw materials and materials in the provision of services and products, preferring the materials that cause the least damage and least pollution to the environment in the system, reducing the waste rate by recycling the waste materials generated during the production processes are some of the most basic practices of sustainable systems (Vivien, 2008).

Economic sustainability is based on the relationship between humans and nature. One of the most important international agreements that emerged as a result of global cooperation in this field is Agenda 21. Agenda 21 is one of the five declarations published as a result of the World Summit and is known as the action plan of the sustainable development approach. Agenda 21 emphasizes the necessity of organizing economic systems and policies within the framework of sustainability in addition to ensuring social and environmental sustainability in order to achieve the goals and objectives of sustainable development. Some of the articles of the Agenda 21 document on sustainable economic systems are presented below. These are;

- Minimizing environmental problems caused by production technologies and economic strategies, planning policies in a way that does not harm the environment,
- Transforming production and consumption policies into sustainable systems,
- Planning economic and environmental policies on the basis of mutual benefit (Walshe, 2011).

In sustainable economic systems, environmentally friendly and controlled use of all kinds of resources used in the formation, distribution and consumption processes of products and services is essential. It is a requirement of a sustainable economy that economic policies, production and consumption models, state and private sector institutions are structured on the basis of long-term use by adhering to the principles and objectives of sustainable development and taking social responsibility. In sustainable economies, economic activities are obliged to consider future generations while meeting the needs of individuals and societies, planning debt management and formulating investment policies. Economic sustainability is inextricably linked to social and environmental sustainability. Economic sustainability also shows the limits of economic growth (Reddy & Thomson, 2015).

# 2. Sustainable Society

Social sustainability refers to the equal and equitable satisfaction of the needs and requirements of all members of society without discrimination. Social or societal sustainability is the capacity to provide all individuals with needs such as security, health, education and housing at a welfare level. For a society to be sustainable, the individuals who make up the society must live in prosperity and have a productive, healthy and stable structure (Tobón & Luna-Nemecio, 2021).

If there are negative situations such as inequality in income distribution, increase in health problems, dissatisfaction and unrest in a society, the short-term relief and improvement provided by temporary solutions to these problems is not sustainable unless continuity is ensured. In sustainable societies, individuals have equal living conditions and fair income distribution. Unemployment, lack of education, poverty, problems in

the health system, unsafe and uninhabitable settlements and an unfair justice system are important obstacles to the sustainability of a society. The social dimension of sustainable development addresses issues related to improving the living conditions and standards of present and future generations. In this context, all elements required for a better quality of life constitute the social dimension of sustainable development. It aims to ensure global prosperity, peace and tranquility by contributing to the development and positive change of all segments of society (Mi & Coffmann, 2019).

For a sustainable society, there are various duties for all individuals and certain rights and freedoms that must be provided to all individuals. Some of these include

- Ensuring gender equality in all societies,
- Ensuring social justice for all individuals,
- Equal treatment of all individuals on earth without discrimination,
- Ensuring the right to education for all individuals around the world,
- Ensuring that all individuals around the world benefit equally from health systems,
- Creating safe and healthy residential areas for all individuals on earth and ensuring that they live in peace in these areas,
- Ensuring that all individuals around the world benefit equally from social services,
- Improving the well-being of all individuals and societies,
- Ensuring cultural diversity in all societies,
- Ensuring respect and sensitivity to social life,
- It is listed as taking responsibility at individual and social level for a sustainable society (Altuntaş, 2012; IUCN, 1991).

# 3. Sustainable Environment

Today, with the rapid increase in the world population, it is a fact known by all individuals that natural resources are limited and should be used cautiously. We have pushed the capacity of our planet to its limits due to unconscious environmentally hostile behaviors that have been practiced in the past and are still being practiced today. For this reason, it is of serious importance that every decision taken or every step to be taken is realized with future generations in mind. In this context, it is an individual and social responsibility to use systems that do not harm natural systems and ensure the sustainability of water and soil while meeting the needs of today's people. The requirement of a sustainable environment is that all living things continue their lives without diminishing the resources of future generations (Morelli, 2011).

What is meant by sustainable environment is that we can offer a livable environment to future generations by improving the current environmental conditions. The most basic solution to this idea is to minimize our negative impacts on the environment. In this context, some practices that need to be done to achieve a sustainable environment have been identified. Some of these are;

- Careful, limited use and protection of our planet's natural resources,
- Ensuring the sustainability of biological diversity, protecting species in danger of extinction,
- Reducing carbon dioxide emissions from anthropogenic sources,
- Encouraging and expanding the use of renewable energy sources,
- Encouraging tree planting, protecting and increasing forest areas,
- Taking measures to prevent all kinds of environmental pollution,
- Recycling of used materials and wastes back into the system,
- Implement measures to reduce the increase in global warming and thus avert a global climate crisis,
- Supporting environmentally friendly activities and organizations,
- Increasing the number and effectiveness of institutions and organizations for environmental protection and development,
- Ensuring the preservation of the historical texture,
- Reducing the ecological footprint on a global scale (UNESCO, 2006).

Ensuring the sustainability of the environment can be expressed in the most basic sense as keeping the rate of depletion of our natural resources lower than the rate at which the planet can renew itself, but it also includes keeping all practices that harm natural systems under control. For a sustainable environment, the capacity of the ecosystem should not be exceeded and biodiversity should not be harmed while meeting the needs of individuals. The prerequisite for sustainable development is a sustainable environment (Sutton, 2004).

A sustainable environment, economic system and social structure are the three main dimensions of sustainable development. The area where these three fundamental dimensions intersect shows us the area of sustainable development. Well-educated individuals are the most basic and effective way for the sustainable development approach to achieve its goals and objectives and to be adopted as a lifestyle for individuals. In this context, education is the key to the full realization of sustainable development. In order to emphasize the necessity of education for sustainable development, the period between 2005 and 2014 was declared as the "Decade of Education for Sustainable Development" by the United Nations. The main goal of this decade is to ensure that all individuals acquire the knowledge, attitudes, values, behaviors and skills necessary for a sustainable future (Teksöz, 2014). Considering that a sustainable environment is a prerequisite for sustainable development, the importance of the quality and effectiveness of environmental education emerges. In 1977, the definition and aims of environmental education were determined in the Tbilisi Declaration published at the Intergovernmental Conference on Environmental Education organized in cooperation with UNESCO and UNEP. In this declaration, environmental education is defined as "the education given to individuals with the aim of raising awareness, knowledge, sensitivity, positive attitudes and skills on environmental issues, supporting the necessary motivation to develop environmentally friendly behavior, and enabling them to produce ideas and solutions for environmental problems" (UNESCO, 1978). When the definition of environmental education in the Tbilisi Declaration is examined, it is seen that the definition is made in the context of environmental literacy. In this sense, it would be correct to think that the aim of environmental education is to raise individuals as environmentally literate individuals. The main purpose of environmental education, which is the basic point for sustainable development to achieve its goals and which should be provided to all individuals, is to ensure that all individuals are raised as environmentally literate. In this context, environmental literacy is a necessity for a sustainable life and future. Because only environmentally literate individuals can ensure the realization of the prerequisite of sustainable development by ensuring the sustainability of the environment.

# **Environmental Literacy**

Although literacy as a term was known in the past as a word expressing only the ability to read and write, today it refers to the state of having deeper and more comprehensive knowledge on the relevant subject. In this context, this concept has become quite different from its origins in the past. The scope and domain of the concept of literacy, which was known as the ability to communicate with written or printed symbols between individuals in the past, has developed and changed over time. Especially in recent years, in order for an individual to be called a literate individual, he/she should have a high comprehension capacity, be able to make informed decisions, be sensitive and aware of his/her environment, and exhibit a solvent attitude towards problems and problems (McBridge at al, 2013).

Environmental literacy is one of the types of the concept of literacy, which expresses the state of having much more skills than reading and writing skills in the age we are in. The concept of environmental literacy is one of the most important concepts in environmental education literature. It is known that the first emergence of the concept of environmental literacy was an article written by Charles Roth in Massachusetts Audubon in 1968. This concept has been defined in different ways by different researchers over the years. Therefore, there are many different definitions in the literature (Disinger & Roth, 1992).

# **Environmental Literacy as a Concept**

The oldest and most general definition of the concept of environmental literacy is the level of personal environmental knowledge and awareness present in individuals. The term environmental literacy refers to the interactive link between individuals and natural systems. Individuals who establish a sustainable connection with their environment are defined as environmentally literate individuals. In this context, the concept of environmental literacy is defined as the existence of knowledge, attitudes, skills, motivation and awareness of the environment and environmental problems in a balanced and holistic manner (Roth, 1992; Wright, 2006). Environmental literacy is not simply a matter of creating awareness. It is to develop in-depth and meaningful knowledge, environmentally friendly behaviors, sensitivity and emotional dispositions towards the environment. The environmental literacy model developed by Simmons (1995) is known as one of the first model attempts developed within the scope of the North American Environmental Education Association. This environmental literacy model addresses the goals for environmental education in the Tbilisi Conference, the Belgrade Charter, and the environmental education program prepared by Hungerford et al. in 1980 with a holistic approach (Köklü Yaylacı & Feriver, 2020).

Environmental literacy is a comprehensive understanding of the interactions and relationships of individuals and societies with their environment. In this context, an environmentally literate individual is expected to understand and evaluate the effects and functions of practices and activities in all fields such as technology, culture, science, agricultural activities on natural systems, that is, the environment, and to be an individual who strives for a sustainable environmental structure. While defining environmental literacy, Roth (1992) emphasizes observable environmentally friendly behaviors. According to Roth (1992), environmental literacy is the ability to transform environmental knowledge into behaviors and to exhibit these behaviors (Morrone at al., 2001; Hernandez, 2005; Moseley, 2000).

When Roth (1968) defined environmental literacy, he also identified the characteristics that an environmentally literate individual should have. These are;

- Knows that social and natural systems are interrelated. Understands that this relationship is bidirectional, that is, systems are affected by and affect each other.
- Knows that human and nature are a whole that should not be considered separately.
- Knows the effects of developments in science and technology on natural systems.
- Knows that what needs to be learned about the environment is not a periodic but a lifelong process.

Ramsey (1987) mentioned some characteristics that an environmentally literate individual should have. According to Ramsey (1987), an environmentally literate individual;

- Have sufficient understanding and success in environmental activity strategy development, planning and implementation.
- Be sensitive to the environment.
- Have awareness of the positive or negative effects of individual and social behaviors on the environment.
- Have a negative attitude towards all kinds of behaviors that will harm the environment.

Disinger and Roth (1992) emphasized in their study that environmentally literate individuals should have the knowledge, environmentally friendly behaviors, beliefs, attitudes and skills necessary to recognize and prevent environmental problems. Morrone at al. (2001) stated that environmental literacy cannot be mentioned unless environmental knowledge is transformed into environmentally friendly behavior and attitude. Loubser at al. (2001) identified the characteristics of an environmentally literate individual that should be observed. According to Loubser et al, characteristics of an environmentally literate individuals;

- They have sufficient knowledge about the environment.
- They can recognize and understand our planet and feel responsible for it.
- They should find solutions to what they see as problems in the world and contribute to their personal environment. Make serious, personal decisions about environmental issues, if necessary.
- They have knowledge about natural resources and natural systems. Recognize renewable and non-renewable resources. Have knowledge about environmental problems and solutions.
- They should be able to share their knowledge with the individuals around them. If necessary, they should carry out informative studies. They should know the interaction of social components such as culture and politics with the environment.

# **Components of Environmental Literacy**

Over time, many different researchers have tried to identify the components of environmental literacy. Willis (1999) listed the components of environmental literacy as knowledge, emotional disposition, motivation and skills. According to Hsu (1997), the components of environmental literacy are sensitivity, awareness, attitude, skill, active participation and knowledge. According to Caha (2000), the triad of knowledge, skills and attitude constitute the components of environmental literacy. These three basic areas contain the values that individuals should have. Ruchter (2007) stated that environmental literacy has many components. According to Ruchter (2007), knowledge, attitude, value, interests, norms, self-confidence, perceived behavioral control, behavioral desire, and

behavior are some of these components.

Although the definition of environmental literacy as well as its components are interpreted differently by different researchers, researchers have reached a consensus on the boundaries of environmental literacy. Based on this idea, five basic areas have been identified as the components of environmental literacy with a general opinion. These five basic areas are awareness, knowledge, attitude, skill and action, respectively. The main purpose of environmental education is to raise environmentally literate individuals. In order to raise environmentally literate individuals, all individuals must be successful in these five basic areas. In the absence of any step, environmental literacy cannot be mentioned. However, in the case of the presence of these five basic areas in the individual, the individual can be characterized as an environmentally literate individual, and the goals of environmental education can only be achieved by raising environmentally literate individuals and bringing them into society (Figure 2) (Elder, 2003).

# Figure 2.

Five Key Domains of Environmental Literacy



Among these components, awareness can be defined as individuals being aware of the events and situations that occur in their daily lives. In the concept of awareness, attention is consciously focused on an event, flow or situation. In a state of awareness, an individual acts consciously, knowing the causes and consequences of a situation or event. For example, when it comes to the environment, the individual is aware that global warming is a serious problem. In the information stage, the individual has a basic understanding of the environment and the problems related to it. At the attitude stage, individuals show a set of values, a sense of concern for the environment, and motivation to actively participate in its improvement and protection. In the abilities stage, individuals gain practice for the experiences gained in the previous stages. Individuals at the behavioral,

action stage, which is the most difficult and final stage of environmental literacy, adopt and exhibit positive behaviors towards the environment (Elder, 2003; UNESCO, 1978).

Over the years, different researchers, groups and organizations have worked to achieve the main goal of environmental education, which is environmental literacy. One of these efforts belongs to the National Project for Excellence in Environmental Education (NPEEE). This project, which is realized in the USA, carries out a large number of studies to create various standards in environmental education. According to the standards set by NPEEE, there are certain characteristics that an environmentally literate individual should have. These are listed as asking and analyzing questions, knowing environmental issues and natural systems, being aware of and understanding environmental problems, and taking responsibility individually and collectively to improve the environment (Benzer, 2010).

# **Environmental Literacy Levels**

Environment and human beings are two elements that cannot be separated from each other. These two elements are in an interaction that complements and completes each other. Looking at the behaviors of the individuals who make up the society, it is observed that some individuals are aware of the importance of this relationship, while the other half of the society is not very aware of this relationship. In this sense, observable behaviors are very important for environmental literacy. In this context, environmental literacy dimensions were determined based on observable behaviors. These dimensions are listed as Nominal Environmental Literacy, Functional Environmental Literacy and Operational Environmental Literacy from basic to advanced (Figure 3) (Loubser at al., 2001).

# Figure 3.

Levels of Environmental Literacy



Nominal Environmental Literacy is the most basic and first level of environmental literacy. Individuals with this level know the concepts related to the environment and the meanings of these concepts. They begin to develop awareness and sensitivity towards nature and natural systems at the initial level. Functional Environmental Literacy is the second level of environmental literacy. Individuals at this level have the skills and ability to make sense of the relationship between the environment and humans. Individuals have a deep understanding of the structure and functioning of natural systems and their



relationship with humans. They have knowledge about the problems and solutions that will occur according to the nature of the interaction between the environment and humans. They share this knowledge with other individuals. Operational Environmental Literacy is the highest level of environmental literacy. Individuals with this level have turned environmentally friendly behaviors and ideas into a lifestyle. Behaviors and actions for the benefit of the environment are at the forefront. Individuals at this level have the environmental knowledge required for a sustainable environment and the ability to transform this knowledge into behavior. They take responsibility for environmental issues and actively participate in environmental activities to inform the rest of society. For individuals at this level, the understanding of environmental literacy is integrated into every moment of life and is adopted as a lifestyle (Cutter & Smith, 2001; Goldman at al., 2006).

As mentioned before, the ultimate goal of environmental education is to ensure that all individuals are raised as environmentally literate. In this context, Liang at al (2018) determined the cognitive, affective and psychomotor dimensions of environmental literacy and the components of these dimensions in their study (Figure 4).

# Figure 4.

Cognitive, Affective and Psychomotor Dimensions of Environmental Literacy



The researchers identified knowledge of ecology, knowledge of environmental problems and knowledge of appropriate action strategies as the components of the cognitive dimension. The researchers listed environmental awareness and sensitivity, environmental values and attitudes towards making decisions on environmental issues as the components of the affective dimension, and identified intention to act, environmental action strategies and skills, and participation in environmental behaviors by feeling responsible as the components of the psychomotor dimension.

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# Innovative Thematic Activities in Sustainable Development Education

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# Sustainable Development

A human being has been in direct interaction with the environment and uses it in line with their needs to maintain his life since the first day of his existence on Earth. Natural conditions on Earth sometimes comfort people's lives and sometimes create complicated situations. The human being, faced with some problems and needs throughout his life, tries to adapt to the environment and nature to survive and change his background (Özbuğutu, Karahan, & Tan, 2014). This situation has been the case since the beginning of human existence. However, since the beginning of the 20th century, human environmental changes have reached unprecedented magnitudes. Humans think they have the right to consume nature unlimitedly to live well. Unfortunately, nature no longer finds the opportunity to renew itself due to rapid population growth, increasing needs, and the need for excessive consumption (Karakoç, 2004; Önder & Güven Yıldırım, 2021). Unless the world can renew itself, natural resources essential for life, such as air, water, and soil, will be polluted at an alarming rate. Population continues to increase rapidly; meanwhile, agricultural lands required for food supply, forests that provide ecological balance, and, more importantly, biological systems are rapidly disappearing. Toxic gases and wastes that threaten future generations are increasing worldwide. The increase in greenhouse gases, global climate changes, the depletion of the ozone layer, and the rate of depletion of natural resources cause many social and societal problems. The Living Planet Report states that the vertebrate population will decrease by approximately 52% quickly (WWF, 2014). Today's environmental problems appear as the new cost of industrial society. Obviously, destroying the environment and making it uninhabitable in the name of economic growth is incompatible with any goal (Karaca, 2007).

Scientists have concluded that human beings are the most fundamental cause of environmental problems, which started with the Industrial Revolution and extended to the present (Legget, 2007). The balance of the world is deteriorating day by day due to the excessive ambition of people (Özey, 2004). Instead of living in harmony with nature and benefiting from nature in line with their needs, people pollute, exploit, and destroy nature. This situation causes severe global problems and threatens the world (Karaca, 2007). The best solution to eliminate this threat is not to consume natural resources if not necessary or to consume less, transforming resources by reusing them. In short, it is necessary to ensure the transfer of natural resources to future generations (Tiras, 2012). At this point, the concept of sustainable development emerges. The conceptual foundations of sustainable development date back to the 1970s (Walshe, 2013). In the early 1970s, a group of economists and scientists published a report titled "Limits to Growth." In this report, they stated that the Earth has a limited supply of physical resources and warned that consuming these resources could result in disaster (Du Pisani, 2006). The United Nations Environment Conference was held in Stockholm in 1972 and catalyzed the adoption of international agreements on ocean pollution, pollution from ships, and trade in endangered species (Paul, 2008). The concept of sustainability was included in most of the principles adopted by the conference, and it was stated that development should be sustainable. It focused on issues related to the use of natural resources and economic and social issues (Du Pisani, 2006).

The word sustainability means to continuousness and to continue. Sustainable development is meeting the needs of the present so that future generations can meet their own needs (United Nations General Assembly, 1987). In other words, sustainable development is meeting the needs of both present and future generations by considering individuals' basic needs and the natural environment's self-renewal capacity (Conca & Geoffrey, 2004).

#### **Sustainable Development Education**

The concept of sustainable development education first came to the fore at the United Nations Earth Summit in Rio Janeiro in 1992 (Fischer et al., 2015; Jickling & Wals, 2008). The teaching and learning approach adapted to sustainable development issues is called sustainable development education (Olsson & Gericke, 2016). Sustainable development education also means uninterrupted education that enables individuals to take sustainable

actions and provides them with the necessary knowledge, attitudes, skills, and values (UNECE, 2005). Sustainable development education has several principles, including intergenerational equality, gender equality, social tolerance, poverty, protection of the environment, protection of natural resources, and the right to live in peaceful societies (Brunold, 2006). In educating people for sustainable development, Orr (1994) identified six pillars of education:

- Education in the fields of science should include environmental education.
- Environmental issues are complex and cannot be explained by a single discipline. Institutions should provide interdisciplinary transformation.
- For individuals residing in the same places, education should be given through dialogues on the characteristics of reasonable consumption. Thanks to these conversations, it will be ensured that people accept the existence of other people living around them so that they do not act selfishly and respect the lives of others around them.
- How education is done is as important as the content of education. Environmental education must, therefore, be oriented to real-life conditions and needs because real learning is experiential and participatory.
- Experiences on Earth are both a practical part of understanding the environment and an aid to good thinking. To understand nature, one must have good observation and field intelligence.
- Education is about building a sustainable society.

Sustainable development education has been introduced in schools as a new and comprehensive education program in recent years (Öhman & Ostman, 2008). Sustainable development education focuses on making the younger generation future responsible citizens (Walshe, 2013).

Sustainable development education provides students of all ages with the knowledge, skills, values, and mediation to address interconnected global issues such as climate change, biodiversity loss, unsustainable use of resources, and inequality. It empowers students of all ages to make informed decisions and take individual and collective action to change society and care for the planet. Sustainable development education is a lifelong learning process and is an integral part of quality education. It develops the cognitive, socio-affective, and behavioral dimensions of learning and covers learning content and results, education, and the learning environment itself (Özer, 2023). An effective education for sustainability can be achieved by changing students' knowledge, attitudes, values, and behaviors (Fien, 1997).

In 2014, the document "Education 2030" was prepared by UNESCO. For the

years 2015-2019, targets, objectives, priority areas, and a roadmap have been determined. The report includes five priority areas (UNESCO, 2022):

- Integrating sustainable development into international and national policies,
- Transforming learning environments into sustainable learning environments (EKO-School green campus),
- Ensuring that in-service and pre-service professional development programs are compatible with sustainable development education in order to develop the capacities of educators,
- Conducting workshops that will strengthen young people's sustainable development visions,
- Increasing the quality of local platforms to strengthen the local dimension of sustainable development.

It is stated that sustainable development should be included in the curriculum at all class levels in schools. On the other hand, these programs need to be developed to equip individuals with knowledge and skills (UNECE, 2005). For this, UNESCO (2013) recommends using activities such as simulations, class discussions, storytelling, drama, peer counseling, games, music, design, and drawings in lessons. A practical, sustainable development education should be prepared following the level of the student and should include various teaching methods and student-led projects (UNECE, 2005). Fien and Trainer (1993) underlined that sustainable individuals can be prepared during the education process and that transforming values and attitudes into behaviors is possible by deeply addressing and expanding sustainable development issues. In addition, for individuals to understand sustainable development, the three-dimensional structure of sustainable development should be handled with a holistic approach (Wolbring & Burke, 2013). Researchers state that sustainable development does not belong to any discipline alone, but various disciplines can contribute to sustainable development at specific rates (McKeown, 2002). At this point, innovative thematic activities for sustainable development education in all disciplines can be practical.

# **Innovative Learning**

Innovation is defined as the degree to which an individual accepts innovations relatively earlier than other members of his environment (Midgley & Dowling, 1978). Individual innovation refers to the individual's desire to adopt the new, apply, use, and benefit from the innovation. Institutional innovation, on the other hand, refers to the institutional implementation of new ideas suitable for the characteristics and structure of the institution (Kılıçer, 2011; Rogers, 2003).

Innovative learning means that students regularly learn new things, question the information they have learned, and think about new ideas independently (Upadhyay, 2020). By changing the teaching style and method, the teacher incorporates creativity and innovation into the teaching process (Kalyani & Rajasekaran, 2018). In short, any dynamic, system-wide change that aims to add value to educational processes and outcomes is defined as innovative learning (OECD, 2009). Kalyani and Rajasekaran (2018) state that innovative teaching is necessary to help students reach their full potential. However, it is emphasized that teachers' competence in innovative teaching is the most important factor affecting the quality of teaching. At this point, Kalyani and Rajasekaran (2018) presented some suggestions to teachers. These suggestions were given as love the work done, using audio and video tools in the lessons, using the brainstorming technique, including out-of-school activities in the lessons, role-playing, puzzles and games, supporting creativity, and introducing the lessons like a story. Innovative learning is possible with the existence of innovative schools. Turan and Cansoy (2021) stated the main characteristics of innovative schools as follows:

- Using different evaluation methods
- Active use of informatics and web-based learning in blended learning in and out of school learning
- Establishing professional cooperation with the teacher
- Providing out-of-school learning opportunities
- Community participation in the education process
- Providing 21st-century skills-focused learning
- Providing individualized education that pays attention to the individual differences between students
- Courses are generally project-oriented or project-based in a way to develop inquiry
- Designing a flexible learning environment
- Accepting families as the focal point and their participation in learning at school
- Preparing a flexible training program
- Use of strong teaching and learning approaches
- Encourage cooperative learning
- Openness to innovation and arousing the desire to try new applications.

As mentioned above, it is essential to use various learning methods and techniques in the lessons in order to ensure innovative learning. Innovation aims to raise individuals who can think creatively, keep up to date, and create a more qualified and effective teaching-learning process (Taş, 2017). One of the methods and techniques that can achieve this goal can be considered thematic learning.

## **Thematic Learning**

In the literature, there are many definitions of thematic learning. Jacobs (1989) states, "It is an approach that uses more than one discipline, method and knowledge to teach a theme, concept, problem." Yıldırım (1996) states, "It is the presentation of traditional subject areas by bringing them together in a meaningful way around certain concepts." According to Miller (2005), "Thematic learning means helping individuals to live more consciously in their own society and natural environment."

In thematic learning, themes are centered, and teaching is based on these themes. The main thing here is to gather the information forming the theme under one roof and to reveal its relations with the central theme (Öztürk & Dilek, 2003). The thematic approach states that learning activities should be developed around "Generative Themes," which are a part of the cultural environment of the students. Generative themes increase students' motivation, contribute to their being critical individuals, and expand their knowledge about the subject. (Canas, Novak, & Gonzalez, 2004). Meanwhile, thematic learning allows teachers to adapt their knowledge and skills to real-life situations by removing the boundaries created around the lessons taught separately. Students with different intelligence in different disciplines when learning a skill or concept. During the learning process, students make transitions from concrete concepts to abstract concepts through applied and active learning experiences. Through play and exploration, children discover their world. In integration models, students combine their perceptions of sight, hearing, and touch, allowing them to use these powers (Cone et al., 1998).

With the curriculum updated in 2005, it has been suggested to use thematic learning in educational environments, and the reasons are listed as follows (MEB, 2005).

- To increase study potential and thus their self-confidence by motivating students with individual differences and to ensure that this situation is reflected in different courses,
- To increase students' awareness of their environment, their ties with the environment, and their awareness of how they can make a difference,
- To ensure students' respect for different points of view by capturing them.
- To develop team spirit in students,

- To enable students to gain knowledge and skills through the activities they will participate in,
- To improve the study habits of students,
- To improve students' attitudes towards school.

In light of the information mentioned above, it is of great importance to provide an education under a common sustainable development theme in all courses taught in schools since the topics of sustainable development, which is one of the environmental issues, are complex and cannot be explained by a single discipline (Orr, 1994). In this context, innovative thematic learning activities are included as an example of teaching sustainable development in secondary schools.

# **Innovative Thematic Activity Examples**

In this section, sample activities that can be used in "Sustainable Development" education are given in the following courses taught in secondary schools affiliated to the Ministry of National Education in Turkey;

Activity 1. Science Course; making alcohol-free cologne

Activity 2. Turkish Course; preparing a panel

Activity 3. Mathematics Course; creating and interpreting a chart

Activity 4. Social Studies Course; preparing an upcycling project exhibition

Activity 5. Foreign Language Course; designing a taboo game

Activity 6. Information Technologies and Software Course; creating a digital content

Activity 7. Religious Culture and Moral Knowledge Course; making creative drama

Activity 8. Visual Arts Course; drawing a picture

Activity 9. Music Course; designing Wheel of Fortune for composing

Activity 10. Physical Education and Sports Course; making compost with competition

Activity 11. Technology and Design Course; designing a project

# **Preparation Class**

In order to teach the subject of sustainable development with activities, first of all, students should be informed about these activities. For this reason, in the first place, students are informed about innovative thematic activities, the aims of the activities and the classroom applications of these activities. Again, sustainable development, the importance of sustainable development for our country and the world, and the goals of sustainable development are briefly explained to the students. It is explained to the students that due to the integrated and interdisciplinary nature of sustainable development, a joint learning process will be carried out in all courses. Students are made ready and willing to do the activities.

#### **Activity 1. Sample Activity for Science Course**

In order to teach the subject of sustainable development in the Science Course, students are asked to design projects for the efficient use of resources. First of all, what the project is, its aims and application steps are explained to the students. Afterwards, students are asked to research products that can be used in making alcohol-free cologne and to bring the products they choose to produce alcohol-free cologne to class when they come to the Science class the next week. Students are also instructed to bring empty cologne bottles to class along with these products. The next week, students bring distilled water, vinegar, lemon and orange/lemon peels, fragrant flowers, rose petals and various essences of their choice when they come to class. Then the students start cologne production. Under the guidance of their teachers, students produce their own colognes from these products and put them in bottles. Alcohol-free cologne that can be used easily and safely in daily life is obtained. Sample images of colognes prepared by students are given in Figure 1.

#### Figure 1.

Sample images of colognes prepared by students



With this activity, waste materials are evaluated, resources are used sparingly, and cologne is produced at a very low cost. In addition, as a result of this activity, an in-class application is carried out for the purpose of "to realize the mutual interaction between the individual, the environment and the society; to develop awareness of sustainable development regarding society, economy and natural resources", which is among the objectives of the Science Course Curriculum (MEB, 2018a).

#### Activity 2. Sample Activity for Turkish Course

Students are informed about the panel, which is a form of oral expression, within the scope of Turkish Lesson. What the panel is, the parts of the panel, the features of a good panel, the rules to be followed in the panel are explained, and examples of panels made before are examined in class. Then, it is explained to the students that in the next lesson, a panel will be held in the classroom with the participation of the students. Until the next lesson, students are asked to do research on the subject of "Efficient Use of Resources for Sustainable Development" and to scan the relevant resources. In the next lesson,



panelists are selected from the students on a voluntary basis, and a panel chairman is also selected. Then the panel started. In accordance with the panel rules, each student presents the information and data obtained as a result of their own research to their friends. Afterwards, a discussion environment is created within the class on the subject. At the end of the panel, the chairman of the panel concludes the discussion by making inferences about the subject. And the panel ends. Sample images of the panel and the panel chairman's presentation papers are given in Figure 2.

Sample images of the panel and the panel chairman's presentation papers

With this activity, first of all, one of the general objectives stated in the Turkish Course Curriculum; "ensuring that students express their feelings and thoughts, their opinions or thesis on a subject in an effective and understandable way, verbally and in writing" and "developing students' ability to access, organize, question, use and produce information from printed materials and multimedia resources" objectives are provided (MEB, 2018b). In addition, thanks to this activity, sustainable development education is given to the students by discussing the economical use and importance of resources for sustainable development.

# Activity 3. Sample Activity for Mathematics Course

Students are given one week to find the amount of materials such as plastic, glass, metal, paper, cardboard and wood produced since 2018. They are also told to research how much of these products that are put on the market are recyclable. Students bring their research results to the next Mathematics course. Students report the statistical information they obtained from the research results. Then this information is transferred to paper as tables and graphics. Finally, students interpret the results obtained from tables and graphs and make data-based predictions about the scarcity of resources and the status of resources for future generations. Sample images of the graphics prepared by the students are given in Figure 3.

# **Figure 3**. Sample images of graphics



With this activity, students gain skills such as researching, collecting data, reporting data, putting data results into tables and graphs, reading tables and graphs, and making forward-looking predictions. In addition, they gain awareness of the current situation of resources, their sustainability and the resource problems that future generations will experience. With this activity, students also acquire the skills of "researching, producing and using information" and "making sense of the relations between people and objects and the relations of objects with each other by using the meaning and language of mathematics", which are among the special objectives of the Mathematics Course Curriculum (MEB, 2018c).

## Activity 4. Sample Activity for Social Studies Course

Before coming to the Social Studies course, students are asked to make preliminary preparations and collect the waste materials (paper, cardboard, plastic bottles, jars, etc.) that they consider recyclable in their homes for a while. During the week of the activity, students bring the waste they collect to school. In addition, before the activity starts, dried branches and leaves in the school garden are collected together with the students. Students are divided into small study groups and each group is asked to collaboratively transform their waste materials into a new product using their imaginations. At this point, the students are told about the concept of waste, recycling, upcycling, and zero waste. The place and importance of these issues in the protection of natural resources is explained, and the contribution of waste evaluation to the national economy is emphasized. All materials brought to the classroom by the students are placed on the cardboards laid in the classroom in such a way that they do not scatter and pollute the environment. Materials such as scissors, utility knives, rulers, crayons, etc. that the



# Figure 4.

Sample images of the project exhibition and projects



With this activity, students learn about the concept of waste, recycling and upcycling, zero waste and the importance of these concepts. Students develop the ability

to design a product. At the same time, the course is taught in accordance with the purpose of "students become aware of the limitations of the natural environment and resources, try to protect natural resources with environmental awareness, and have a sustainable environmental understanding" which is among the general objectives of the Social Studies Course Curriculum (MEB, 2018d).

# Activity 5. Sample Activity for Foreign Language Course

English course is chosen for the activity to be done in the Foreign Language course. Before the activity starts, it is explained to the students that the game will be played in the lesson. Then, the key concepts of sustainable development are written on the board in the form of a table in both English and Turkish. The teacher makes students work on these concepts for a while. Meanwhile, the students try to learn the English of the keywords. Then, the English cards that will form the Taboo game are prepared with students. After the English Taboo cards containing the keywords of the relevant subject are prepared, the class is divided into groups. Each group competes in turn and all groups are given an equal amount of time. Each group chooses a narrator for the first round. And the game has started. The narrator tries to explain the word on the Taboo card to his/her friends by paying attention to the forbidden words. Groupmates try to say the English equivalent of the key concept. The group that finds the English translation of the key concept gets points. After all groups have played the game, the group with the most points wins the game. Sample images of the Taboo game are given in Figure 5.

#### Figure 5.

Sample images of the taboo game



With this activity, students not only have a pleasant learning experience by playing games, but also learn the English of key concepts related to sustainable development. Thus, "to increase students' interest in learning the target language and to enable them to use this language in real life" and "Students learn the language with pleasure through games, activities related to real life, drawing-painting, role-playing, listening-speaking, and narration" targets, which are the main objectives of the English Course Curriculum, are achieved (MEB, 2018e).



# Activity 6. Sample Activity for Information Technologies and Software Course

Web.02 tools are taught to the students in line with the outcomes in the Information Technologies and Software course. Then, students are asked to prepare original banners, slogans or posters on the subject of sustainable development by using Web.02 tools. Students freely create banners, slogans, posters and even word clouds. Afterwards, the prepared digital contents are published on the school web page and all students are provided with access to these contents. In this way, it is ensured that other students also gain awareness of sustainable development. Sample images of digital content prepared by students are given in Figure 6.

# Figure 6.

Sample images of digital content



With this activity, students create creative digital content for sustainable development and efficient use of resources. In addition, the purpose of "to enable students to use information technologies effectively and in accordance with their purpose" specified in the Information Technologies and Software Course Curriculum is realized (MEB, 2018f).

# Activity 7. Sample Activity for Religious Culture and Moral Knowledge Course

In the Religious Culture and Moral Knowledge course, first of all, students talk about the understanding of the environment in sacred religions, respect for nature, sustainable development goals and the efficient use of resources, under the guidance of their teachers. Students are asked to give examples from religious sources, religious information, and the lives of prophets on the subject. The place and importance of the environment and natural resources in religion is discussed. Then, the creative drama activity started. The creative drama technique and the application of this technique are explained to the students with examples. In the course, a few preparatory and trial studies are carried out in which the students will take part. Then, ten students are selected from the class on a voluntary basis. Five of these students assume positive behaviors towards the efficient use of resources for sustainable development, and five students assume roles that will exhibit negative behaviors. Students are given some time to prepare and edit for their roles. Afterwards, a creative drama activity is carried out in the classroom. After the creative drama activity is completed, discussions about the creative drama activity are held in the classroom environment. Sample images of students' creative drama work are given in Figure 7.

# Figure 7.

Sample images of creative drama



With this activity, students realize the importance of protecting the natural environment and using resources sparingly, which are included in their religious beliefs. They learn how bad it is to waste resources and what consequences it can have. At the same time, a course is taught in accordance with the purpose of "students' understanding of the effects of religion on social life, culture and civilization elements", which is among the objectives of the Religious Culture and Moral Education Course Curriculum (MEB, 2018g).

#### Activity 8. Sample Activity for Visual Arts Course

In the Visual Arts course, the following objectives of sustainable development are explained to the students; "to end poverty, eliminate hunger, to provide health services for a healthy and balanced life, to provide equal opportunity in education, eliminating gender inequality, improve water and hygiene infrastructure, increase energy efficiency and consumption of renewable energy sources, provide decent work and economic growth, to make investments in innovation, industry and infrastructure, provide justice,



build sustainable cities and communities, to create a sustainable consumption and production system, climate action, protect aquatic life, protect terrestrial life, to create peaceful, just and strong institutions, provide cooperation and support". Students are asked to do research on these 16 objectives and bring their research results to the Visual Arts class. In the Visual Arts course, students are asked to draw pictures for the goals of sustainable development, taking into account their research. Sample images of the drawings made by the students are given in Figure 8.

# Figure 8.

Sample images of drawings



With this activity, students realize a learning experience for the goals of sustainable development. In addition, the goal of raising students who associate Visual Arts with other disciplines, which is among the main objectives of the Visual Arts Course Curriculum, is realized (MEB,2018h).

# Activity 9. Sample Activity for Music Course

For the activity to be done in the music course, a game of Wheel of Fortune material is prepared with the students. Sustainable development goals are written on the wheels of the Wheel of Fortune. After the Wheel of Fortune material prepared with the participation of the whole class, the students in the class are divided into 4 groups. Each group gives themselves a nickname and the competition begins. One student from each group comes to the board in turn and spins the Wheel of Fortune, and the sustainable development goal that appears on the Wheel of Fortune belongs to that group. Sustainable development goal that has come out to one group is removed from the Wheel of Fortune and the other group comes to the board to spin the wheel. After all groups have turned the wheel and chosen a goal, all groups are asked to write a song about their goal and compose a composition with these words. All groups are given some time for this. At the end of this period, a willing person from the group comes to the board and sings the song for the sustainable development goal of their group to the whole class. Other groups rate this song. And this process is repeated until all the group ' songs are finished. If desired, the game can be continued until the 16 goals of sustainable development are completed. At the end of the activity, the group with the most points wins the game. Sample images of the Wheel of Fortune are given in Figure 9.

#### Figure 9.

Sample images of the Wheel of Fortune



With this activity, students work on the goals of sustainable development by playing games and having fun. In addition, due to the memorability of the lyrics, learning about sustainable development goals becomes more permanent. In addition, an activity for the purpose of "to enable students to express their feelings, thoughts and experiences through music" in the Music Course Curriculum is carried out (MEB, 2018i).

#### Activity 10. Sample Activity for Physical Education and Sports Course

Students are asked to make a preliminary preparation before coming to the Physical Education and Sports class. Students are assigned to collect organic waste from home and school for a while. During this time, students collect waste such as egg shells, vegetable and fruit wastes, and newspapers in their homes. In addition, dried branches, leaves, tea and coffee wastes in the school garden are also collected by the students. Students bring all the waste they collect to the Physical Education and Sports class. It is explained to the students that they will make compost with the materials brought. In addition, what compost is, what it is used for and its benefits are explained. Emphasizing sustainability, the importance of using organic wastes as compost is mentioned. Then, all students are taken to the school garden/gymnasium, and identical racetracks with various obstacles are set up in the school garden/gym with the students. In some of these racetracks, students are required to run straight, in some of them dribbling, in some of them they have to complete the racetrack by jumping over obstacles. Then the starting

C

point of the racetracks is determined. The other end of the racetracks is determined as the waste point where the wastes will be collected. Cardboard boxes are placed at the waste point and all the waste brought by the students is placed at this point in a way that does not pollute the environment. Then the class is divided into as many groups as the number of racetracks. The groups should be equal to each other in all respects and the number of students in the groups should be equal. Each group is given compost columns made from waste carboys. Also, each group member wears gloves. Then the students are told that there will be a competition and the rules of this competition are explained. The aim of this competition is to cross the racetrack starting from the starting point and to return to the starting point by taking as much waste material as possible from the waste point. At the end of the game, the winner of the game is determined by the excess amount of waste brought. At this point, it should be carefully explained to the students that speed and game completion are important, but that the winner will be the group that brings the most waste to the starting point. Then the competition begins. Each group passes to the starting point of the equal racetracks. The students choose a group name for themselves by talking among themselves, and also determine the order in which the players enter the game. Group members start the game with the starting whistle and compete individually, respectively. Until one group member completes the racetrack and returns to the starting point with the waste, the other group member cannot start the racetrack. The competition continues until all group members have completed the racetrack. The competition is over when all group members of any group have finished the racetrack and returned to the starting point. When the game is over, students who cannot play the racetrack may remain in groups that are not fast enough. The rule is that all group members complete the racetrack as soon as possible and bring as much waste as possible to the starting point. After the time is stopped, each group fills their waste into their own compost column. Equal amount of water is given to all groups and they are asked to add this water to their compost. Finally, the compost column of each group is weighed. The group that makes the compost with the most waste wins the game. The prepared composts are poured to the bottom of the trees in the school garden after waiting for the required time. Sample images of the compost competition are given in Figure 10.

# Figure 10.

Sample images of the compost competition



With this competition, students not only have a fun lesson in a competitive environment, but also make compost that can be used to improve the structure of the soil by evaluating organic wastes. With this activity, one of the main objectives of the Physical Education and Sports Course Curriculum is "to develop communication skills, cooperation, fair play, social responsibility, leadership, sensitivity to nature and respect for differences through physical education and sports" target is achieved (MEB, 2018j).

# Activity 11. Sample Activity for Technology and Design Course

In the Technology and Design Course, it is explained to the students that they will design a project. Students are informed about what the project is, its features and how to prepare it. Then the students are divided into groups. Students in the groups are asked to design heat-insulated house models for the efficient use of resources. All the necessary materials are given to all groups and students work to design a project during the lesson. At this point, students can create the main skeleton of their houses from cardboard, prepare the roof of the house using styrofoam, add doors and windows to their houses, and paint the exteriors of their houses in the colors they want in their heat-saving house projects. Again, some groups may stick aluminum foil to the windows in order to save heat, and some groups may cover the exterior of the house with thermal insulation materials (cotton, foam, styrofoam). Sample images of the projects made by the students are given in Figure 11.



Figure 11. Sample images of students' projects



With this activity, students designed project houses that can save energy with thermal insulation materials in line with the sustainable development theme. In addition, an activity was carried out in the Technology and Design Course Curriculum with the aim of "to enable students to take responsibility for the solution of the problems they encounter in daily life and to use technology development processes and design skills in the solution of these problems" (MEB, 2018k).

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# A New Approach in Environmental Education: Eco-Pedagogy

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# Introduction

21st century competencies, which have recently attracted great interest in the world and Turkey, are integrated into the education system and shed light on individuals' social perspectives and global orientations. Based on the view that competent individuals can be raised as a result of the interrelation of different disciplines, the education system in line with 21st century skills emphasizes the capacity of individuals to play a decisive role in certain issues. These issues are diversified such as financial literacy, civic literacy, health literacy, environmental literacy, and even today, additions are being made to these topics. Ecological literacy, which emerged during these additions and occupies an important place for global awareness, is a phenomenon that can reveal the relations of living things with environmental factors and integrate this into the individual's mindset under the title of education. Based on this phenomenon, the concepts of "ecology" and "pedagogy" intertwine over time and reveal a new phenomenal concept.

# Ecology

The concept of environment, in which living and non-living beings sustain their lives, is classified at certain levels by dividing it into different titles. With these classifications, the examination of all phenomena that have an important place in terms of environmental science under certain patterns facilitates the work of the society and contributes to continuity within the systemic framework. The concept of ecology, which is one of the classifications and derived from the Greek concept of "Oıkos" and whose foundations

date back to Charles Darwin's studies on the development of humanity (Özkalp, 1992), was first used in 1869 by German scientist Ernest Haeckel in a study on plant systematics (Marshall, 1999). The concept of ecology, which was introduced to the literature based on Haeckel's studies and shaped over time by incorporating the reflections of different perspectives, is a phenomenon that reveals the distribution of living things in an environment, their quantities and their relationships with other living or non-living things in their environment (Stauffer, 1957).

The concept of ecology has brought along many currents of thought since it first began to take shape as a result of the studies on it. With different perspectives on the concept, it has been interpreted in various ways and factual foundations that will continue for centuries have emerged. It is possible to mention that there are different views on the concept of ecology, such as eco-socialism, eco-feminism, as well as environment-oriented studies. However, it has been clearly demonstrated that this difference is not only shaped according to the perspectives, but also according to the solutions offered to the ecological problems that arise according to the returns of time or according to the characteristics of human and society (Görmez, 2010).

When it is observed that today's orientation towards the concept of ecology shows an environment-oriented approach, the question "How was the relationship between ecology and environment established in ancient times?" comes to mind. In fact, the answer to the question is clear. The differences of opinion that emerged as a result of the differentiation of perspectives developed towards the environment and environmental problems led to the emergence of ecological philosophical movements as a result of the coming together of certain ways of thinking. The most prominent of these movements is radical environmentalism. The movement adopts respect for nature and natural life as the main goal by making certain inquiries within the framework of national policies. In short, the movement is based on the idea that the human-environment relationship should be regulated at this level by opposing the depletion of natural resources. The ecocentrism movement is an approach that argues that people in industrial cities should respect nature and greenery (Yıldırım, 2017). The universal ecological thought synthesized based on these approaches includes many currents and ideas that contain different views.

Since its emergence in ancient times, the idea of ecology has often been confused by scientists with the idea of protecting the environment, and no clear orientation can be stated on this issue. However, although they both include environment-oriented studies, they are shaped on different factual foundations. While environmental conservation thinking is a natural environmental living environment based on the concept of nature, which constitutes the sphere of human use and emerges with passive patterns by bringing together certain objects, ecological thinking is an approach that reveals the holistic relationship between nature and human beings (Bookchin, 2013). As a result

of the inferences shaped around all these intellectual patterns, it has been revealed that the concept of ecology is an approach based on the balance and harmony in human and nature relations, and it has become a field of study, especially by biologists. However, the ecological crisis that has emerged in recent years as a result of temporal conditions has brought to the agenda the necessity for many scientists to carry out more studies in this field, leading to an increase in trends towards this field and an increase in interest in phenomena such as technology, industrialization and common environment. As a result of the increase in the number of studies and researchers interested in this field, the subject contents that have been examined more deeply have also led to the emergence of a number of new concepts, and environmental-oriented ecological thinking has begun to expand. These concepts have been introduced to the literature by characterizing them as population, which refers to organisms living in a certain environment in relation to each other, community, which refers to areas where various species live together within the population, ecosystem, which is the intersection area of community and environment, and ecosphere, which emerges as a result of the interconnection of regional ecosystems on the world (Özkalp, 1992). When we look at the main purpose of the concepts revealed as a result of all these studies and researches, we see that there should be a certain order and interdependence in nature. It is observed that some common views have been put forward for ecological thought to be shaped in this direction in order to create a healthy nature-based society. These views are; (a) perceiving nature as a whole and revealing the interconnection of environmental relations with each other, (b) being against growthoriented economic studies that may harm nature, (c) being careful and cautious against technological developments brought by the age (Kılıç, 2006).

Based on these characterizations, even if the importance and place of the concept of ecology for human history is clearly revealed, the emergence of ecological destruction as a result of some environmental factors is an inevitable problem. Human life, which is shaped around the benefits of the age we live in, is beginning to have a high level of relationship with industrial and technological developments. Although the positive results of these effects cannot be ignored, it is an undeniable fact that they have negative consequences for the environment and ecological order. Environmental pollution and excessive consumption of natural resources, which are the most prominent of the emerging problems, are clearly evident that the natural balance in the ecosystem has started to deteriorate over time, as it shows its effects in many areas from the living spaces of living creatures living in the ecological order to their nutritional opportunities. So can we prevent these problems? Can social awareness be raised against environmental pollution or unconscious use of natural resources? At what age range and at what level can environmental awareness activities be given? The answer to all these questions lies in raising awareness of the individual and reveals the importance of its place in the education system. Because, as Miller (2012) mentions, awareness is the first step towards change. At this point, the concept of ecological balance (Lummis, 2002), which is shaped by environment-oriented teaching, comes to the fore. It is an undeniable fact that the most important awareness opportunity for ensuring and protecting ecological balance is education.

The concept of literacy, which reveals the level of competence of individuals in certain areas and is based on the idea that individuals should have questioning views towards the phenomena in their lives by creating changes in their way of thinking, has an important place in the field of ecology. An ecologically literate individual should have the ability to synthesize nature and human relations with his/her own thoughts, pay attention to natural processes and resources, produce solutions by approaching issues such as climate change with a critical point of view, and exhibit a nature-friendly approach, and these characteristics should become one of the life goals of the individual. Thus, with the educational activities shaped on the basis of these themes, it can be aimed to create an individual and then a social consciousness and awareness as a result of contributing to environmental literacy rates by ensuring that individuals are primarily ecologically literate (Aydin et al., 2016).

## Ecopedagology

Human beings are in constant and balanced interaction with their environment. In some cases, this interaction can be environmentally or socially beneficial, while in others it can be harmful. What are these situations of benefit or harm? Who is responsible in case of damage to the environment and ecological order as a result of human actions? How can the individual be made aware in terms of revealing the damages? The answers to all these questions are examined under two headings in order to offer a different perspective on environmental education. Thus, the questions are stated as not knowing what the consequences or returns of the behaviors that have been done or have been done and accepting continuity by being conscious of one's actions (Misiaszek, 2020). In order to prevent these negative attitudes, the necessity of a synthesis that will reveal the continuity between education and the environment was emphasized.

The concept of ecopedagogy, which emerged with the integration of environmental awareness into the education system as a result of synthesizing studies, is a philosophical approach that advocates respect for human beings, nature, social life and human-environment relationship as a result of the ideas revealed with a critical perspective developed against the environment and ecological education (Gronemeyer, 1987; Morrow & Torres, 2002; Kahn, 2010). Studies have revealed that this approach, which aims to reveal the relations between nature and human beings, has three main components. These are classified as natural, social and holistic ecology.

*1. Natural Ecology:* It is aimed to protect nature and ensure its continuity (Kahn 2010).



**2.Social Ecology:** It is aimed to reveal the impact of human beings, one of the main components of the environment, on nature and the natural process (Kahn, 2010).

*3.Holistic Ecology:* In accordance with 21st century competencies and opportunities, it is aimed to present an ecological perspective on civilization studies through economic, social and cultural structure (Kahn, 2010).

However, Zocher and Hougham (2020) examined the concept of ecopedagogy in three sub-dimensions: critical theory and curriculum ideologies, eco-justice and planetary citizenship, care and participatory dialogue (Figure 1).

#### Figure 1.

Ecopedagogy Themes (Zocher & Hougham 2020)



The "Our Common Future" report published by the World Commission on Environment and Development (WCED) in 1987 was a pioneering work that ushered in a new era in the field of environment, while the idea of sustainable development aimed to prevent the destruction of natural resources and prevent environmental damage. In line with these objectives, the themes addressed by updating the studies have started to change shape and the importance given to social awareness-raising activities has increased. Based on the view that education systems are the best way to raise the level of awareness in society, the concept of ecopedagogy, which incorporates the concepts of "ecology" and "pedagogy" and clearly synthesizes these two concepts, found its place in the literature in 1992. In a study by Gadotti (2008), the term ecopedagogy is characterized as an approach that can reveal the atrophied sustainable development pedagogy in society and emphasizes the importance of a critical perspective.

It is observed that the foundations of the concept of ecopedagogy, which is shaped in line with the objectives, emerged in the works of Paulo Freire (1999) when it is characterized as a philosophical view. In 1999, Paulo Freire and his advisor Moacir Gadotti introduced the concept of ecopedagogy, which became an educational perspective that began to be followed at the First International Earth Charter Symposium organized by the Earth Council and UNESCO (Khan, 2008). Over time, the perspective

on the concept has expanded and the concept of ecopedagogy has been introduced to the literature by Paulo Freire, as well as world-renowned pedagogues and educators such as Moacir Gadotti, Francisco Gutierrez, Cruz Prado, Patricia Abuhab, Guilherme Blauth, Richard V. Kahn, Stefan K. Grigorov, who have carried out many studies in the field and made efforts to develop the theory under thematic headings (Grigorov, 2012).

Ecopedagogy, described as an innovative and popular educational movement in Latin America, is a critical view that seeks to reveal the benefits and harms of human behavior to the environment as a result of social orientations, as well as an environmental pedagogy approach that aims to achieve a balance of social and environmental justice by using the opportunities brought by education (Misiaszek, 2016). Based on all these definitions, the ultimate goal of an ecopedagogical education is to strive to shape the perspectives between the social order and the environment in order to ensure the continuity of the living environment and to ensure the continuation of the universal balance. It is clearly demonstrated that the effects of pedagogical studies to be carried out in line with the objectives will be shaped positively both individually and socially.

The main orientation of the concept of ecopedagology is to draw attention to the concepts of environmental, social and planetary bullying that arise as a result of negative situations by revealing the ecological balance between the environment, society and the world, and the idea that this unjust order should be criticized and corrected. While environmental bullying means the loss of the continuity of the ecological balance as a result of human behavior, it is revealed that it is closely related to social and planetary bullying (Misiaszek, 2020). Because the reason for the emergence of environmental bullying phenomena is due to the imbalance in society-environment relations.

#### Figure 2.

Environmental, Social and Planetary Bullying Relationships (Misiaszek, 2020)



The problem situations that ecopedagological studies focus on are stated as revealing the relational dimension of environmental and social bullying (unconscious behaviors). Thus, the relational dimensions of the concepts help us to reveal whether teaching is being done or not and its deficiencies, thus enabling us to make inferences with better quality and ecological principles. The importance of the continuous relationship between these two concepts in terms of the world is also revealed with the planetary bullying relationships, and it is aimed that individual responsibilities and rules gain a universal value, while ecological pedagogy education developed on the basis of these views is frequently used not only in environmental education but also in many subject areas such as social, cultural, historical, religious, etc. (Gronemeyer, 1987; Kahn, 2010). The most important element in these trainings is that individuals reveal their own ecological identities as a result of questioning and critical perspectives without being exposed to stereotypical limitations such as right or wrong (Irwin, 2010). Thus, it is aimed to associate the concept with different disciplines and to develop attitudes that can exhibit a holistic approach to the connection between the environment and human beings.

In short, as Angela Antunes and Moacir Gadotti mention, "Ecopedagogy is a life-centered pedagogy and its aim is to create new eco-pedagogical relationships in the lives of people who can be the creators of a new and more beautiful world so that they can raise awareness of themselves and those around them" (Grigorov, 2012). Thus, it is clearly observed in the studies that this critical approach is a victory for both the education system and environmental awareness, and that it can be useful for protecting the natural life in the world and creating a cleaner future for new generations.

# **Ecopedagological Literacy**

The environment, which constitutes the living spaces of living and non-living beings, is exposed to certain effects over time and destructions occur. Environmental education, which is included in the education system in order to prevent these damages and to initiate improvement efforts, aims to raise individuals who adopt nature-friendly and sustainable development awareness. For this purpose, the ecopedagogy approach, which came into our lives as a result of the integration of the term ecology, which is one of the subheadings of the concept of environment, and the education system, adopts the philosophy of ensuring that the individual plays an active role in all processes related to nature and ensuring a continuity that will continue until future generations (Freire, 1970). Undoubtedly, this philosophy is based on the individual being competent in the subject area. Despite the ecopedagogy approach, it will be able to appropriately fulfill the requirements of another approach that adopts competencies, critical thinking, and research-inquiry based thinking.

Ecopedagogical literacy is basically defined as literacy education for reading and rereading human actions related to environmental violence (Misiaszek, 2020). An ecopedagogical literate individual is expected to produce effective solutions to problem situations encountered in nature while being required to read and research at certain levels in the field of ecology (Khan, 2010). However, ecopedagogical literacy involves seeking world balance instead of ending something in nature (Misiaszek, 2021). Thus, over time, it will become easier and possible to prevent negative attitudes such as globalization and insensitivity to social problems and to protect the natural balance.

#### Ecopedagogy in the World and Turkey

The concept of ecopedagogy, which tries to draw attention to the importance of respecting nature by synthesizing ecology and education, is a form of approach that has been studied by scientists since its emergence in order to expand its meaning and allow it to be universally accepted (Grigorov, 2012).

The concept, the foundations of which were laid by Paulo Freire in 1992, was introduced to the literature as "ecopedagogy" by Gronemeyer in 1987 (Okur et al., 2015). Subsequently, the concept, which has diversified studies on the subject area in the world and in Turkey, has been handled by researchers with different dimensions. Lummis (2002), one of these researchers, revealed the perspective on the concept of ecopedagogy within Australia's educational reform movements. According to the findings of the study, the country's ecopedagogical thought has been updated as structuralist and it is emphasized that priority should be given to creating an environment where teachers can question in economic, social and political areas in the programs prepared.

In the study conducted by Walter (2009), the philosophical approaches on which environmental education in North America is based are classified as liberal, progressive, behaviorist, humanistic and radical, and it is aimed to adopt contemporary learning methods suitable for ecopedagogy. Walter argues that the balance between the environment and human beings can be preserved and the concept of sustainability can be realized in the strongest way when the purpose of the education examined within the framework of ecology and education is updated in liberal philosophy with a focus on emotions, progressive philosophy with a focus on social norms, behavioral philosophy with a focus on self-development and radical philosophy with a focus on eco-justice.

Thomashow (1998), who adopted the concept of self-identity based on Walter's humanistic philosophy in the field of ecopedagogy, stated that each individual will adopt a certain ecological identity by creating their own philosophy. Thus, people will be able to reveal their pros and cons by questioning, criticizing and synthesizing the inferences obtained in line with their own knowledge and skills, and will be able to take responsibility for leaving a clean world for future generations (Okur, 2012).

In addition to the studies conducted in the world, when the equivalent of the concept of ecopedagogy in the Turkish literature is examined, Eryaman et al. (2010) investigated the effect of ecopedagogical trainings based on social foundations on various data collection groups. According to the findings of the study, as a result of the
trainings, it was seen that teachers had a good understanding of the relationship between sustainability, ecology and education and were willing to transfer information about nature activities and the importance of protecting natural resources.

Based on all the researches, it will be possible to say that the concept of ecopedagogy is effectively integrated into the education system in the world and in Turkey and that incentive studies are carried out in order to raise solution-oriented individuals against the environmental problems that are emerging day by day.

#### Conclusion

Although the concept of ecology, which is shaped within the framework of the concept of education, includes various field studies, it clearly emphasizes the relationship between the concept of education and ecology by aiming to raise environmental awareness in terms of the philosophy it is based on. At the same time, since the first times when the concepts of ecology and environment were introduced into education, the objectives have always been shaped in this direction and the regulations focused on catching up with the age are based on these philosophically based thoughts.

The approaches taken as a basis within the education system differ in various aspects within a certain periodic framework. While it is generally argued that critical perspectives on the education system adopt a classical teaching style and do not encourage individuals to think about social events (Eisener, 2002), concepts such as ecology and environment have started to approach the system from different angles and as a result of these studies, phenomena such as the concept of eco-pedagogy, which will find a significant place in the literature, have been derived. The ecological pedagogy approach, which emerges as a result of the derived concepts and is put forward in detail based on the forms of approach, emerges as a movement of thought that aims to provide the individual with intellectual thinking skills as well as being important in the education system. Thus, this approach, which was seen only as a philosophical thought in the first times it was put forward, enables individuals to reveal their environmental attitudes shaped by their own thoughts without being stuck in the factual patterns of right and wrong (Irwin, 2010).

"Environment" is a term that refers to all components of the natural or artificial space in which an organism (e.g. a human, animal or plant) lives. The environment affects many different factors, such as human health, the economy and social well-being. Therefore, environmental protection and sustainability are important to improve the quality of people's lives. The main source of future adverse situations that may arise as a result of human and environmental interactions is closely related to the resilience and productivity of natural systems, and this relationship is being threatened day by day (Orr, 991). People's perspectives on social awareness, education and culture levels, which are one of the factors that reveal this situation, highly affect their level of awareness about

the environment and the natural system. Because education is not only a system in which individuals learn conceptual facts, but also enables them to grow up as well-equipped individuals with critical and questioning perspectives.

Environment and ecology are also areas that occupy a large place in education systems and that individuals should attach great importance to in order to leave a clean world for future generations. The term eco-pedagogy, developed through the concept of ecology, which draws attention to the interactions of living beings with each other and their environment, is a subject area that has gained a place in the literature with its critical perspective that defends the idea that living beings should be able to protect their living spaces and respect all phenomena within the system, and many studies have been carried out to raise awareness of individuals in this direction. "Eco-pedagogy" or "Ecopedagogy" is an educational approach that focuses on ecological sustainability. This approach aims to sensitize students to the environment and make them aware of sustainability issues. Ecopedagogy is an approach to which teachers and educators from many different disciplines contribute. This approach is seen as an important tool for raising environmental awareness in the education system and society at large.

Along with the concept of ecopedagogy, the concept of ecopedagogical literacy emerges. This type of literacy includes topics such as raising awareness about the effects of human activities on the natural environment, exhibiting conscious consumer behavior regarding the use of natural resources, promoting environmentally friendly practices and encouraging sustainable development. At the same time, this literacy encourages individuals to take responsibility for their own lives and the environment, helping to work towards a more sustainable and healthy future.

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## **Environmental Ethics, Climate Justice and Social Justice**

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As we contemplate the future of our planet, exploring the intricate interplay between concepts like environmental ethics, climate justice, and social justice provides us with a vital compass not only for safeguarding nature but also for constructing a fairer future for humanity. These three pillars of thought not only converge at the intersection of sustainability but also hold the keys to addressing some of the most pressing challenges of our time. In the following pages, we will delve into the profound connections among environmental ethics, climate justice, and social justice, unraveling the complex tapestry that binds them together and shedding light on the pathways to a more just and sustainable world.

#### **Environmental Ethics: Understanding Our Moral Relationship with Nature**

Ethics, as a philosophical pursuit, revolves around the examination of values and the rationale behind morally correct and virtuous behaviors, drawing insights from the influential writings of philosophers such as Aristotle (who focused on virtue ethics), Kant (who emphasized duty-based ethics), and Bentham and Mill (pioneers in utilitarian and consequentialist ethics) (Horner, 2003; Shaw, 1998). Ethics, often described as 'norms for conduct that distinguish between acceptable and unacceptable behavior,' serves as the cornerstone of our understanding of morality (Resnik, 2015). It not only guides our judgments about what is right or wrong in human behavior but also shapes our collective values, fostering a shared framework for distinguishing acceptable actions from those that fall outside the boundaries of ethical conduct (Huang et al., 2019; Kraut, 2009). In this context, Brennan and Lo (2019) present two fundamental moral questions that have played a crucial role in shaping our ethical frameworks: (1) What kinds of

things are intrinsically valuable, good, or bad? (2) What determines the moral rightness or wrongness of an action? In exploring the first question, which concerns intrinsic value and the nature of things deemed valuable, we delve into the domain of values and moral worth. This inquiry fundamentally focuses on what humans and societies consider valuable, as values hold a significant role in shaping individuals' lives, behaviors, and decisions. Concepts such as human life, freedom, and equality often serve as examples of intrinsic value. The second question, addressing the moral rightness or wrongness of actions, forms the other facet of ethics. Here, we scrutinize moral actions and decisions, exploring how individuals, societies, or communities evaluate the ethical standing of specific actions. This examination encompasses an investigation into how ethical theories and principles assess and categorize actions based on their underlying moral values. Consequently, it involves the process of determining whether an action is just, honest, or unjust. These two questions are the cornerstones of ethical thought and are used to deeply understand moral thinking. Determining values and moral principles (the question of value) and evaluating which actions are right or wrong based on these values (the question of action) play a fundamental role in the development and application of ethical theories and approaches. Brennan and Lo (2019) argue that the answers to the question of action are derived from the responses to the question of value, emphasizing the interconnectedness of these two aspects in ethical reasoning.

Before delving into the realm of environmental ethics, it's worth noting that the vast field of ethics encompasses various specialized branches, each addressing unique ethical concerns and moral dilemmas. These branches include but are not limited to medical ethics, business ethics, and media ethics (DuBois et al., 2014; Painter-Morland & Deslandes, 2016; Schwartz, 2007), each with its own set of principles and ethical considerations. Environmental ethics is a branch of philosophy that explores the intricate moral and ethical dimensions of our interaction with the natural world (Callicott, 1989; Clegg, 2000; DesJardins, 2013; Rolston III, 1988). At its core, it prompts us to grapple with fundamental questions about the value of nature, our responsibilities towards the environment, and the ethical guidelines that should govern our actions in addressing pressing environmental concerns (Brennan & Lo 2019; Imran et al., 2011).

#### **Environmental Ethics and Its Development**

The emergence of environmental ethics in the second half of the 20th century was indeed closely tied to the increasing awareness of environmental problems and the impacts of human activities on the natural world. Several key factors contributed to the development of environmental ethics during this time (Light, 2000; Minteer & Collins, 2008; Payne, 2005; Routley, 1973):

Industrialization: The rapid industrialization that occurred in many parts of the world led to increased pollution, deforestation, habitat destruction, and other environmental issues. As people witnessed the negative consequences of industrialization on the environment, they began to question the ethics of these activities.

Technological Advances: Advances in technology, while offering many benefits, also had negative environmental impacts. For example, the widespread use of automobiles and the development of industrial processes were associated with air and water pollution.

Population Growth: The global human population was growing rapidly during this period. The increased demand for resources and space put additional pressure on the environment.

Resource Depletion: As more resources were extracted and consumed to support growing populations and industries, it became evident that some resources were finite and could be depleted.

This realization raised ethical questions about the responsible use of natural resources. However, it's important to note that "The Limits to Growth," (Meadows et al., 1972) published by the Club of Rome, significantly contributed to the formation of environmental ethics by introducing several crucial concepts:

Finite Resources: The book argued that natural resources on Earth are finite, and it introduced the concept that an unlimited growth model is unsustainable. This perspective challenged the prevailing notion of infinite economic and population growth.

Environmental Issues: The Limits to Growth warned that unchecked growth would result in environmental problems, including the depletion of natural resources and environmental pollution. This highlighted the urgent need for ethical considerations in how humans interact with the environment.

Rights of Future Generations: The book emphasized the rights of future generations to inherit a planet capable of sustaining life. It stressed that excessive resource consumption by current generations would threaten the well-being and even the right to life of future generations. This concept of intergenerational equity and environmental justice became a core principle in environmental ethics.

In addition to The Limits to Growth, other significant works have also contributed to the development of environmental ethics, such as:

Silent Spring-Rachel Carson (1962): This book focused on the environmental impacts of pesticide use and the conservation of natural life. It had a significant influence on environmental ethics and awareness.

The Ecology of Commerce-Paul Hawken (1993): This book examined the relationship between business and environmental sustainability, discussing the ethical responsibilities of businesses in environmental matters.

The Sixth Extinction-Elizabeth Kolbert (2014): This book addressed the increasing rate of species extinction on our planet and evaluated the impact of human activities on the natural world.

A Sand County Almanac- Aldo Leopold (1949): This work presented thoughts on the conservation of the natural world and ethical relationships between humans and nature.

The Nature of Things-Lucretius (B.C. 1st century): This ancient Roman work explored the value of nature and the ethical relationship between humans and the natural world.

These books and works, along with "The Limits to Growth," have collectively contributed to the development and expansion of the concept of environmental ethics, encouraging individuals and societies to consider ethical dimensions when dealing with environmental issues and the sustainability of the planet.

To sum up, the late 1960s and the 1970s witnessed the rise of the environmental movement, significantly elevating the importance of environmental ethics. Key works like Rachel Carson's "Silent Spring" played a vital role in shaping the discourse. During this era, literature increasingly emphasized the impact of human activities on the natural world and the urgency of conservation efforts. In the 1980s and beyond, environmental ethics continued to evolve, integrating intergenerational justice (justice for future generations) and social justice. Environmental ethics began to gain prominence as concerns over limited natural resources and growing environmental issues became more apparent. This mid-20th century shift in perspective led to a focus on the sustainability of natural resources and the intrinsic value of nature. Ethical theories within environmental ethics expanded to address justice not only among humans but also between humans and nature.

#### Harmonizing with Nature: Exploring the Depths of Environmental Ethics

Environmental ethics, as a complex field, encompasses a diverse spectrum of ethical frameworks that shape our understanding of humanity's moral relationship with the natural world. In this context, environmental ethics' discussion primarily centers around three fundamental paradigms: anthropocentrism, ecocentrism, and the often-overlooked but significant biocentrism (Norton, 1991; Samuelsson, 2013; Sovacool et al., 2017; Wapner & Matthew, 2009). These paradigms serve as pivotal axes around which ethical debates concerning humanity's intricate and evolving relationship with the natural environment revolve.

Anthropocentrism, the first paradigm, positions humans at the very epicenter of ethical considerations. It places a primary emphasis on human interests, needs, and desires, often framing nature as a utilitarian resource designed solely for human exploitation and benefit (Droz, 2022; Norton, 1991). In this view, the value of nature is primarily instrumental, contingent upon its utility to human beings. This anthropocentric perspective has historically guided much of our interaction with the environment, influencing policies and practices that prioritize human welfare.

Conversely, ecocentrism represents a fundamental shift in perspective. It adopts an ecosystem-centered approach, recognizing the intrinsic value of ecological systems as interconnected wholes. In this paradigm, nature is valued for its inherent worth, regardless of its utility to humans. Ecocentrism advocates for a holistic perspective on ethical responsibilities toward the environment, emphasizing the interconnectedness of all living and non-living elements within ecosystems (Brennan & Withgott, 2005; Lundmark, 2007; Norton, 1991). It questions the utilitarian use of the environment and advocates for a more equitable and peaceful cohabitation with the natural environment.

Notably absent from the detailed discourse is biocentrism, the third paradigm. Biocentrism posits that all living entities, whether human or non-human, possess inherent value and moral standing. It asserts that each life form has its own intrinsic worth, independent of its utility to others (Taylor, 1986; Varner, 1998). While biocentrism holds a significant place within the realm of environmental ethics, its omission from this discussion is not indicative of its lesser importance. Instead, it reflects a deliberate editorial choice to concentrate on the anthropocentrism versus ecocentrism dialectic, which frequently garners more prominent attention and debate within the field. Biocentrism, however, plays a critical role as an ethical bridge between the two dominant paradigms. It acknowledges the intrinsic worth of all life forms and champions a comprehensive moral standing for non-human entities. By recognizing the inherent value of each living being, biocentrism contributes to a more inclusive and balanced ethical framework, challenging the exclusive prioritization of human interests.

In summary, the omission of biocentrism from our discussion does not diminish its significance within environmental ethics. Instead, it reflects a conscious editorial decision to delve more deeply into the discourse of anthropocentrism versus ecocentrism, which lies at the heart of many ethical discussions in the field. These paradigms collectively offer a comprehensive lens through which we can evaluate and navigate our ethical responsibilities in the context of our evolving relationship with the natural world.

#### **Ethical Challenges and Environmental Issues**

Environmental ethics confronts a variety of ethical dilemmas in our interactions with the natural world. These ethical dilemmas include climate change, biodiversity conservation, resource utilization, and other environmental issues. Climate change questions how we should address the ethical implications of our carbon footprint and contributions to global warming. Biodiversity conservation addresses our moral obligations to protect endangered species and preserve biodiversity. Resource utilization challenges us to

balance the ethical use of natural resources with economic development. These ethical challenges reflect the complex issues we encounter in the practical applications of environmental ethics.

Environmental ethics helps us address these ethical challenges and establish a more ethical and sustainable relationship with nature. It offers the opportunity to recognize the intrinsic value and rights of nature, better understand our environmental responsibilities, and approach environmental issues with greater sensitivity. This encourages individuals to build a more ethical relationship with nature and take a step closer toward creating a sustainable world for future generations.

### Ethical Imperatives of Climate Justice: Bridging the Gap between Environmental Ethics and a Sustainable Future

As we delve into the profound environmental ethics, we find ourselves at the intersection of moral philosophy and socio-environmental responsibility. In the preceding section, we explored the foundations of environmental ethics, recognizing the value and intrinsic worth of the natural world and the moral obligations we have towards it. Now, we embark on a journey to understand how these ethical principles intertwine with the pressing issues of climate change and social justice.

The relationship between environmental ethics and climate justice is multifaceted and interconnected. Environmental ethics provides a moral framework for understanding and evaluating human interactions with the environment, including climate change (Wardrope, 2020). It involves considering the ethical responsibilities and obligations that individuals and societies have towards the natural world. Climate justice, on the other hand, focuses specifically on the ethical dimensions of climate change and its impacts on vulnerable populations (Howard, 2023). It emphasizes the need to address the rights and needs of these populations, as well as the equitable distribution of resources and power in the face of climate change. Populations identified as vulnerable, like interstate migrant waste pickers in urban environments, are particularly exposed to the effects of climate change (Michael et al., 2018).

Environmental ethics and climate justice are closely related because they both involve ethical considerations and values in relation to the environment. Environmental ethics provides the philosophical and ethical foundation for understanding the moral implications of human actions on the environment, including climate change (Wardrope, 2020). It helps to shape the principles and values that underpin climate justice. Climate justice, in turn, applies the principles of environmental ethics to the specific context of climate change (Howard, 2023). It recognizes the ethical responsibilities that individuals, organizations, and governments have in addressing the impacts of climate change and ensuring that vulnerable populations are not disproportionately affected and seeks to rectify the inequalities and injustices that arise from climate change, guided by the

ethical principles of fairness, equity, and solidarity (Barnwell & Wood, 2022).

The relationship between environmental ethics and climate justice is further strengthened by the recognition of intergenerational justice (Howard et al., 2021). Both concepts acknowledge the moral obligations we have towards future generations and the need to consider the long-term consequences of our actions on the environment. Environmental ethics provides the ethical framework for understanding and promoting intergenerational justice, while climate justice applies these principles to the specific challenges posed by climate change.

#### **Historical Context of Climate Justice**

The historical context of climate justice is deeply rooted in a rich tapestry of social movement theory, activism, and ethical principles. It can be traced back to the emergence of social movement theory, which provides critical insights into the formation and evolution of the climate justice concept (Bevington & Dixon, 2005). This theory, grounded in the study of collective actions and advocacy, serves as the foundational lens through which we can understand the dynamics driving the climate justice movement.

One of the defining features of this movement is the flexible and inclusive criteria for membership, a characteristic strongly emphasized by social movement theory (Fominaya, 2010). This inclusivity has been instrumental in fostering a space where a wide spectrum of individuals and organizations, all united by a shared concern for the ethical dimensions of climate change, can actively engage. Furthermore, climate justice activists have been resolute in integrating social and ecological justice principles, addressing issues like racialization and environmental education (McLean, 2013). This recognition has driven them to challenge the historical bias within the environmental movement and advocate for a more diverse and inclusive movement. Learning and pedagogy have played a pivotal role in the climate justice movement, with activists viewing education as a means to transition toward a post-carbon energy system and address the ecological and social damage caused by climate change (Kluttz & Walter, 2018). This educational approach extends to amplifying the voices of the most vulnerable and recognizing the historical injustices and social inequalities that exacerbate the challenges of thriving within the context of climate change (Barnwell & Wood, 2022).

The climate justice movement aligns with key ethical principles, including the polluter pays principle and a broader understanding of historical international injustice. Climate reparations, a feature of global reparative justice, aim to address historical and ongoing climate change impacts on vulnerable communities (Tan, 2023). The movement has also intertwined with struggles for sovereignty and resource justice, pushing back against power dynamics that perpetuate inequality (Tramel, 2018). These injustices, arising from climate change and capital accumulation, have given rise to movements that strive to reclaim control over natural resources. In pursuing its goals, the climate justice

movement has cultivated global justice networks (Routledge et al., 2007), offering platforms for relationality, power-sharing, and mutual solidarity among diverse actors, while grounding their actions in sustainable forms of material resistance. Moreover, language and discourse have played a vital role in shaping the climate justice movement. Activists have engaged in discursive contestations of climate injustice, challenging prevailing narratives and advocating for a more equitable approach to addressing climate change (Fine, 2022).

In summary, the historical context of climate justice is deeply rooted in social movement theory and activism. The movement integrates social and ecological justice, challenges racialization, and promotes inclusivity. Learning, reparative justice, resource justice, and global justice networks all play pivotal roles in shaping the movement. Language and discourse are instrumental in contesting climate injustice and advocating for a more equitable approach to climate change. This historical context underscores the profound ethical concerns at the core of climate justice and its unwavering commitment to equitable climate solutions.

#### **Key Principles of Climate Justice**

Climate justice is underpinned by a set of fundamental principles that shape its ethical framework, guide policy development, and inspire action. These principles reflect the moral imperative to address climate change equitably and inclusively.

Solidarity: At the heart of climate justice lies the principle of solidarity, which unites diverse and distant communities in a shared commitment to addressing climate change (Chatterton et al., 2012). It fosters connections and alliances that transcend local and particular contexts, emphasizing that the responsibility for climate action extends beyond national borders.

Distributive Justice: Another core principle of climate justice is distributive justice, which underscores the fair distribution of resources and benefits, especially in the context of climate change impacts (Sabbagh, 2003). It seeks to rectify historical imbalances and ensure that the burdens and benefits of climate policies are shared equitably.

The Polluter Pays Principle: This widely discussed principle in the international climate debate holds that those responsible for greenhouse gas emissions should bear the costs and responsibilities associated with addressing climate change (Mayne et al., 2016). It places the onus on polluters to take action and make reparations for their contributions to climate change.

The Beneficiary Pays Principle: Complementary to the polluter pays principle is the beneficiary pays principle, which suggests that those who benefit from activities contributing to climate change should bear the costs of addressing its impacts (Portela, 2022). This principle recognizes the need to address historical and ongoing impacts on vulnerable communities.

Procedural Justice: Procedural justice is an essential principle in climate justice, emphasizing the importance of fairness and inclusivity in decision-making processes related to climate change (Swanson, 2023). It advocates for transparent and participatory planning processes that prioritize the voices and concerns of marginalized communities.

The Ability-to-Pay Principle: Recognizing that financial capacities differ among nations and entities, the ability-to-pay principle suggests that those with greater financial resources should contribute more to addressing climate change, taking into account their capacity to do so (Huseby, 2013).

The Principle of Equality of Opportunity: This principle acknowledges the differential impacts of greenhouse gas emissions and aims to restore fairness and equal opportunities for all parties affected by climate change (Pottier et al., 2017).

In summary, the key principles of climate justice encompass solidarity, distributive justice, the polluter pays principle, the beneficiary pays principle, procedural justice, the ability-to-pay principle, and the principle of equality of opportunity. These principles collectively guide efforts to address the impacts of climate change, promoting fairness, inclusivity, and accountability. They underscore the ethical imperative of climate justice and the shared responsibility for a sustainable and equitable future.

# Upholding Equity: Vulnerable Populations, Climate Change, and the Imperative of Climate Justice

The impacts of climate change on vulnerable populations are significant and wide-ranging. Vulnerable populations, including marginalized communities, indigenous peoples, women, children, the elderly, people with disabilities, and those living in poverty, are disproportionately affected by climate change (Nelson et al., 2007; Füssel, 2007). These populations often face social, economic, and political disadvantages that exacerbate their vulnerability (Yadava & Sinha, 2020).

Climate change can lead to increased risks to the health of vulnerable populations. Rising temperatures can contribute to heat-related illnesses, while changes in precipitation patterns can affect the spread of vector-borne diseases and vulnerable populations may also face challenges in accessing healthcare and adapting to changing health risks (King & Gregg, 2021). In terms of livelihoods, climate change can have detrimental effects on agriculture, fisheries, and forestry, which are often the main sources of income and subsistence for vulnerable communities (Michael et al., 2018). Changes in rainfall patterns, temperature, and the availability of water resources can lead to reduced crop yields, loss of livestock, and decreased productivity, further exacerbating poverty and food insecurity (Michael et al., 2018). The impacts of climate change on vulnerable populations are compounded by social and economic factors. Limited access to resources, infrastructure, and social support systems can hinder their ability to adapt and recover from climate-related shocks and stresses (Mehrad, 2020). Discrimination, inequality, and power imbalances can also exacerbate vulnerability and limit the capacity of these populations to cope with and respond to climate change (Terriquez et al., 2018).

Climate justice is closely related to the impacts of climate change on vulnerable populations. It emphasizes the need to address the rights and needs of these populations, as well as the equitable distribution of resources and power in the face of climate change (Gaard, 2015). Climate justice calls for inclusive and equitable approaches to climate action, ensuring that the needs and rights of vulnerable populations are at the forefront of decision-making and policy implementation (Riley, 2020). By addressing the impacts of climate change on vulnerable populations, climate justice aims to promote equity, fairness, and inclusivity in climate action. It recognizes the disproportionate burden that vulnerable populations bear and seeks to rectify the inequalities and injustices that arise from climate change impacts (Nelson et al., 2007). Climate justice also emphasizes the importance of empowering vulnerable communities and ensuring their meaningful participation in decision-making processes (Terriquez et al., 2018).

#### **Climate Justice and International Climate Agreements**

Climate justice is a central ethical concern in climate change discussions. It emphasizes the moral obligation to address climate change in a just and equitable manner. This means considering the rights and needs of vulnerable and disadvantaged populations, both locally and globally. Climate justice recognizes that historically, developed nations have contributed the most to greenhouse gas emissions, while the impacts are often felt most acutely by developing countries and marginalized communities (Schlosberg & Collins, 2014). Ethical dilemmas arise in determining how to fairly distribute the burdens and benefits of climate change mitigation and adaptation. This includes issues related to funding for adaptation projects, technology transfer, and compensation for climate-induced losses and damages.

Several international climate agreements have played significant roles in shaping the global response to climate change. These agreements include:

The Montreal Protocol (Protocol, 1987), adopted in 1987 in Montreal, Canada, and entering into force in 1989, aimed to limit the production and use of substances that deplete the ozone layer. This important environmental agreement not only protected the ozone layer but also contributed to reducing greenhouse gas emissions since ozone depletion can enhance atmospheric warming by increasing absorbed radiation in the stratosphere.

The Kyoto Protocol (Protocol, 1997), adopted in 1997 in Kyoto, Japan, and

entering into force in 2005, required developed countries (known as Annex I countries) to reduce their greenhouse gas emissions to specific targets. The protocol allowed countries with emission reduction commitments to use policy instruments such as carbon markets and flexibility mechanisms. However, the protocol ended in 2012, giving way to the more inclusive Paris Agreement.

The Copenhagen Accord, accepted during the 2009 Copenhagen Climate Conference, outlined common commitments for both developed and developing countries in addressing climate change. While it was not legally binding, the accord paved the way for subsequent climate agreements, including the Cancún Agreements and ultimately the Paris Agreement.

Adopted in 2015 (Agreement 2015), the Paris Agreement stands as one of the most significant international climate agreements. It establishes a worldwide framework with the aim of restricting global warming to significantly below 2 degrees Celsius above pre-industrial levels, while striving to limit it to 1.5 degrees Celsius. Participating countries in the agreement present nationally determined contributions (NDCs) detailing their commitments to emission reductions and adaptation to climate change. While international climate agreements provide a framework for global cooperation, they also pose challenges in terms of enforcement and ensuring that countries meet their commitments.

In closing, climate justice isn't just a standalone concept; it's a vital thread woven into the rich tapestry of social justice. The ethical principles and values driving climate justice are deeply entwined with our broader pursuit of social equality and fairness. As we venture forth into our exploration of social justice, let us remember that addressing the impacts of climate change on vulnerable populations is an indispensable step in this shared journey. Our understanding of climate justice serves as a cornerstone, the foundation upon which we can construct a world that's not only more equitable but also sustainable for all. In the upcoming section, we'll embark on a compelling journey into the intricate dynamics of social justice, exploring how these principles intersect and breathe life into the lives of people across the globe.

#### Social Justice: Concept and Fundamental Principles

Social justice advocates for the fair and equal distribution of resources among individuals within society and the provision of equal opportunities. This concept includes respect for human rights, social participation, and the elimination of discrimination (Hibbert, 2017). Social justice is often closely related to the concept of social good because these two concepts complement each other (Kasper, 2007; Levin, 2020; Mor Barak, 2020).

The primary aim of social justice is to enhance the overall well-being of society.

Reducing inequalities, ensuring that everyone's basic needs are met, and improving the quality of life are contributing factors to social good (Dominelli, 2013; Segal, 2016). In a society where social justice is established, individuals are treated more fairly, which, in turn, contributes to the increase in social good. Social justice is rooted in values such as solidarity, empathy, and respect for human dignity. In an environment where all segments of society have equal opportunities, people can coexist more harmoniously. Therefore, social justice and social good are complementary concepts.

#### **Examples of Social Justice Movements**

Social justice movements encompass a wide range of causes and initiatives aimed at addressing various forms of inequality and oppression in society. These movements advocate for equal rights, fair treatment, and social change to create a more just and equitable world. Examples of social justice movements include:

1. The Civil Rights Movement: This movement, which gained momentum in the 1950s and 1960s, aimed to end racial segregation and discrimination against African Americans in the United States. It led to significant legal and social changes, including the desegregation of schools and the passage of the Civil Rights Act of 1964 (Kim, 2020).

2. Black Lives Matter: This movement emerged in response to police violence and systemic racism against Black individuals. It advocates for an end to police brutality, racial profiling, and the disproportionate targeting of Black communities. Black Lives Matter has sparked widespread protests and calls for criminal justice reform (Hoffman et al., 2016).

3. Feminist Movement: The feminist movement seeks to achieve gender equality and challenge patriarchal norms and structures. It addresses issues such as reproductive rights, equal pay, and ending gender-based violence. The movement has evolved over time, with different waves focusing on different aspects of gender inequality (Choi et al., 2020).

4. LGBTQ+ Rights Movement: This movement advocates for the rights and equal treatment of lesbian, gay, bisexual, transgender, and queer individuals. It has fought for legal recognition of same-sex marriage, protection against discrimination, and the promotion of LGBTQ+ rights and visibility (Vera & Speight, 2003).

5. Environmental Justice Movement: This movement addresses the disproportionate impact of environmental degradation and pollution on marginalized communities. It seeks to ensure that all individuals, regardless of race or socioeconomic status, have equal access to clean air, water, and a healthy environment (Kluttz & Walter, 2018).

6. Disability Rights Movement: This movement advocates for the rights and

inclusion of people with disabilities. It aims to eliminate discrimination, promote accessibility, and ensure equal opportunities in areas such as education, employment, and public accommodations (Ratts et al., 2016).

7. Indigenous Rights Movement: This movement focuses on the rights and sovereignty of Indigenous peoples. It seeks to address historical injustices, protect Indigenous lands and cultures, and promote self-determination and autonomy for Indigenous communities (Einwohner et al., 2019).

These examples highlight the diversity of social justice movements and the range of issues they address. While each movement has its unique goals and strategies, they all share a common commitment to challenging systemic inequalities and promoting social change.

#### Specific Challenges and Debates related to Social Justice

In the field of social justice, practitioners and scholars grapple with a range of complex challenges and engage in thought-provoking debates that shape the trajectory of social justice work. These challenges encompass a broad spectrum of issues, from theoretical foundations to the well-being of activists, and they underscore the intricate nature of the pursuit of justice and equality.

1. Theoretical Foundations: One challenge in the field of social justice is the lack of explicit theories of social justice in research. While there is a growing recognition of the importance of social justice, it is often not well-defined or integrated into the theoretical frameworks of various disciplines Rosenberg (2013). This lack of theoretical grounding can hinder the development of effective strategies and interventions for addressing social injustices.

2. Sustainability and Activist Burnout: Social justice movements face challenges in sustaining their efforts and avoiding burnout. Some movements may engage in unsustainable or exploitative practices, leading to activist burnout or the premature end of movements (Bivens, 2020). This highlights the need for strategies that prioritize selfcare, collective well-being, and long-term sustainability in social justice work.

3. Alternative Forms of Justice: The concept of justice is not limited to traditional legal systems. There is a growing exploration of alternative forms of justice, such as transformative justice and restorative justice, particularly in response to gender-based violence (Kim, 2020). These alternative approaches challenge the dominant punitive justice system and offer possibilities for healing, reconciliation, and community accountability.

4. Structural Inequalities and Peacebuilding: Addressing social justice issues requires going beyond surface-level remedies and addressing the underlying generative mechanisms of injustices (Pherali, 2021). Transformative peacebuilding approaches aim

to address the root causes of structural inequalities and promote positive peace. This involves restructuring social, political, and economic systems to create more just and equitable societies.

5. Affirmative vs. Transformative Remedies: In the pursuit of social justice, there is a distinction between "affirmative remedies" that correct outcomes without changing structural frameworks and "transformative remedies" that aim to restructure the underlying generative framework (Cardozo & Shah, 2016). The debate lies in determining the most effective approaches to address social injustices and achieve lasting systemic change.

6. Climate Change and Displacement: Climate change poses significant challenges to social justice, particularly in relation to displacement and migration. Low-lying island nations, such as Kiribati and Tuvalu, face the threat of becoming uninhabitable due to rising sea levels, forcing their populations to seek refuge in other countries (Kirsch, 2020). This raises questions about the responsibility of nations and the rights of climate change migrants.

7. Intersectionality and Inclusive Movements: Social justice movements need to address the intersecting forms of oppression and privilege that individuals experience. Intersectionality recognizes that individuals may face multiple forms of discrimination based on their race, gender, class, sexuality, and other social identities. Building inclusive movements that center the experiences and voices of marginalized communities is crucial for effective social justice advocacy (McCann, 2006).

8. Activist Well-being: Engaging in social justice work can take a toll on activists' well-being. Burnout, overwhelm, and discouragement are common challenges faced by social justice and human rights activists (Chen & Gorski, 2015). Recognizing the emotional and psychological impact of this work and implementing strategies for self-care and support are essential for sustaining the efforts of activists.

These challenges and debates highlight the complexity and multifaceted nature of social justice work. They call for ongoing critical reflection, collaboration, and the development of inclusive and sustainable strategies to address systemic inequalities and promote social change.

#### The Changing Face of Social Justice

The concept of social justice has evolved and adapted throughout history in response to the changing needs, values, and challenges of societies. These changes have occurred as responses to the needs, values, and difficulties of societies. For instance, the definition and application of social justice today are different and more comprehensive than in previous years.

In the mid-20th century, social justice was often limited to economic equality (Marsden, 1978; O'Mahoney, 1952). However, today, social justice encompasses a broader

perspective that includes gender equality, environmental justice, and the recognition of ethnic and cultural differences (Barakos, 2020; Vicari, 2013). Additionally, social justice is not solely achieved through government intervention but also through an approach that encourages the participation of all segments of society. The rise of social media and increased global connectivity have raised awareness about social justice and opened new avenues for societal change. Therefore, the concept of social justice is an ever-evolving framework that will continue to adapt to the needs and values of societies.

In conclusion, social justice and social good are complementary concepts. Social justice is considered a goal to achieve social good and aims to enhance the overall wellbeing of society. The historically changing nature of this concept has allowed it to adapt to the needs and values of societies, ensuring its continued evolution.

The future of our world is shaped within a context where three fundamental concepts intertwine: environmental ethics, climate justice, and social justice. Environmental ethics advises us to recognize the inherent value of nature and preserve it for future generations, while climate justice presents itself as a crisis that prompts us to question these values and focus on our societal responsibilities. It's at this juncture that social justice, by bringing both concepts together, calls for considering the vulnerable communities most affected by environmental harm and ensuring equitable access to resources. The interconnectedness of these three concepts reflects not only our efforts to protect nature and humanity but also the choices we make in how we live and coexist as a global society. This underscores our commitment to leave a more sustainable and equitable world for future generations, serving as an opportunity to act as part of that commitment. Let's remember that these connections are a reflection of our power to shape our lives on this planet and life itself in a sustainable manner.

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