

# Sustainable Environmental Development Strategies Regarding the Natural Resource Contamination

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## Abstract

Having a healthy and clean environment is of crucial importance to everyone. One of the most important problems today is the concerns resulting from the effects of contamination of natural resources and its transference to the human and environment. The aim of this paper is to introduce solutions to combat environmental contaminations and develop a healthy and sustainable environment. The method was documentary research as review. Among the important findings of this research is application of methods including organic farming, biological control, crop rotation, improving technologies, enhancing the awareness and level of knowledge among farmers, and use of novel and suitable irrigation systems in agriculture in the sustainability and development of agriculture of environment.

**Keywords:** Contamination of natural resources; Environment; Sustainable development

400,000 people life quality by reducing environmental issues associated with draining the polluted water to Shadegan international wetland.

Unfortunately, since industrial revolution, the rate of environmental demolition has increased and now the risk is that humans demolish the earth by their own hands. In Iran, the environment is also being damaged very fast. In the past decade, consumption of chemical fertilizers has brought about adverse environmental consequences including air, water, soil, and landscape pollution as well as problems related to human and other creatures' health [3]. Although it has been a long time that humans have realized the importance of environment in their life, the late decades of the twentieth century are the peak periods of propounding environmental issues. Some countries use natural and environmental resources unfavorably in the production process to enhance their share in international markets [4-6]. This eventually causes environmental degradation and propagation of contamination. The different types of contamination and flow of wastes resulting from human activities, which enter the environment, cause damage to plants, animals, and environmental systems. Emission of contaminants into the air, their discharge into rivers or their absorption by soil incur irrecoverable damages (e.g., increased disease or mortality, diminished reactions and entertainment, etc.) to human welfare. Overuse of natural resources such as raw materials and energy generation using fossil fuels and industrial development have caused increased air and water pollution, production of toxic compounds, as well as industrial wastes and environmental degradation. Nevertheless, throughout the process of development, it cannot be expected that industrial and economic growth occur without changes in the environment. However, it has also been evident that the contaminations generated by human societies exert excessive pressure on ecosystems or biodiversity [7,8]. Without adopting immediate measures of this irrecoverable trend, without following the principles of sustainable development and environmental protection, one cannot conceive a desirable future for the present generation and the subsequent ones [9]. Also, we will bequeath a biologically poor world for the future generations. Environmental degradation and contamination

## Introduction

Today, not only is environmental contamination depriving humans of peace and security, it is also threatening the human entity. For this reason, environmental discussions are among the most serious issues across scientific and political circles. Previously, there were studies conducted on the lack of control strategies for soil salinity and the subsurface water level at Shadegan international [1,2]. "The results show the necessity of the application of management practices and drainage system development to protect the Shadegan International Wetland. Development of the project [sugar production] in its current condition is not recommended" [2]. Based on discussions with local authorities, since the result of the previous study [2] and some other similar analysis showed that applying wastewater management can outweigh its shortcomings, local authorities started applying wastewater management policies. This project have a direct impact on

especially in the second half of the 20<sup>th</sup> century caused scholars to believe that if economic growth and environmental protection does not match each other, then the possibility of a suitable life cannot be conceived for humans on the Earth. Thus, it seems that to achieve sustainable development in the environment and realize the goals and policies projected for achieving a healthy environment, an appropriate solution is essential for meeting the plants' food needs through soil-dwelling creatures [10]. Now, we should ask ourselves whether we are able to save the climatic and environmental status of our surroundings or we let our world become progressively warmer and polluted over time and change into barren desert, which is full of contamination. The aim of this research is environmental protection and sustainable development, which is an indisputable principle, which is widely approved by the public. This necessity has gained more importance in parallel with the growth of industries and technology and in turn incidence of contaminations.

## Materials

### The environment and contamination of resources

From the distant past so far, different conceptions have existed about the environment as well as its condition and effect on human resources. For instance, the environment has been described as a dangerous creature, irregular or as regular phenomena, something independent of humans, vehicles, and as a good at the service of humans, etc. [11,12]. Generally, the environment is the area that has encompassed the life process or interacts with it and consists of the nature, human societies, as well as thinking spaces and human-made, engulfing the entire earth's biosphere [13]. The environment contains a small part of the atmosphere, hydrosphere, and lithosphere. In other words, the environment is a thin layer of the air, earth, and water encompassing the whole life [14]. Brown believes that the term 'environment' can refer to a limited region or the entire planet and even the external space, which has engulfed it [15]. The environment refers to an area on which humans are dependent directly and indirectly, and their activities are associated with it. The negative effects of the environment include waterlogging, soil erosion, extracting soil nutrients, soil salting, water pollution, soil saltiness, water saltiness, desertification, deforestation, diminished level of natural potential lands, negative effects of toxic chemicals used in agriculture on the health of humans and living creatures in the ecosystem [16].

Contamination of resources refers to dispersing or adding external materials to the water, air, or earth to such an extent that its physical, chemical, or biological quality is affected in a damaging way to the humans and other living creatures and plants or works and buildings [17]. There are many natural resources exposed to pollution, which include air, water, and soil, each of which is examined further. Every person breathes about 22,000 times/day and needs around 15 kg of air per day. Typically, humans can survive for five weeks without food and five days without water. However, they cannot survive without

air even for five minutes. Thus, air is one of the vital elements for humans. Healthy and natural air usually consists of 78% nitrogen, 21% oxygen, 0.93% Argon, 0.3% carbonic gas, and trace amounts of neon, helium, krypton, xenon, radon, ozone, hydrogen, etc.

### Air pollution

Air pollution refers to presence of undesirable materials in the air to such an extent that they can develop harmful effects. Indeed, whenever any gaseous, vapor, liquid, solid material or radioactivity or non-radioactivity or a combination of them scatter in the open air, they cause air pollution or development of undesirable odors including fume, smoke, soot, suspended solids, sulfur oxides, nitrogen oxides, carbon monoxide, oxidizers, hydrocarbons, acids, ammonia, etc. This air pollution can harm humans, animals, plants, works, and buildings [18]. Air can be polluted both naturally and artificially.

Natural sources of air pollution include dust storms, forest fires, eruption of volcanoes, scattering of plants' pollens, and leakage of natural gas. Their resultant pollution is a permanent phenomenon; whose value is almost constant across the earth due to circulation of natural processes. Artificial sources of pollutions have a far larger contribution to air pollution, compared to natural resources. They are human made and a result of their activities. Among the major sources of production of artificial contaminations are industries, vehicles, refineries, power plants, commercial and cultural sources, agricultural drainages, laboratories, and hospitals. The major problems resulting from artificial contamination include development of gases such as greenhouse gases, which have established the global climate change, global warming, inversion, acid rains, ozone layer degradation, and their devastating effects to demolish the ecosystem and life of living creatures [8].

The main greenhouse gases include water vapor, carbon dioxide, nitrogen oxide, methane, low atmosphere ozone, fluorocarbon, and per fluorocarbon. These gases are components of the atmosphere and their lifespan (over one decade) lets them scatter uniformly and in a balanced way around the atmosphere, contributing to its greenhouse effect [19].

Water vapor (H<sub>2</sub>O), is a natural greenhouse gas and the most important gas in the earth's atmosphere, claiming the largest percentage of greenhouse effect (36-66%) [20]. The atmosphere's water vapor absorbs a significant portion of emitted terrestrial long wave lengths, where in response to its reflection, part of it reaches the ground level, causing warming. To absorb long wave lengths, this greenhouse gas has an absorption band within the range of 7.2 micron and a very wide band at 3.6 micron [21]. The concentration of water vapor has generally fluctuations and is the dominant chemical in thermal trap. Also, the major part of the natural greenhouse warming is due to the water vapor in the atmosphere. However, human activity does not influence the water vapor concentrations except at local scales (For instance, in lands irrigated close to surface). Thus, its share remains constant at

atmospheric temperature, and it is not considered a greenhouse gas in discussions.

Carbon dioxide (CO<sub>2</sub>) is the most important greenhouse gas in the atmosphere after water pressure in absorbing infrared radiation [22]. It accounts for 62% of the total reflective force of the Earth, which has been produced by greenhouse gases over the past decade. This gas has several specific absorption bands, whose axis lies on the wavelengths of 2.8, 4.3, and 14.9 micron. Carbon dioxide is found at a relatively constant value (0.3%) in the air. Accordingly, it emits constant amounts of the reflected radiation, accounting for about one-sixths of its total [23]. **Table 1** shows carbon monoxide, which develops from breakdown of carbon dioxide, brings about harmful effects for the human.

**Table 1** The complication resulting from carbon monoxide across different concentrations.

Carbon monoxide concentration ppm	Time	Effects
5	20 min	Central nervous reactions
30	8 h	Diminished vigilance and sharpness
100	2-4 h	Mild headache
200	2-4 h	Sense of pressure in the forehead or mild headache
500	2-4 h	Severe headache, weakness, and nausea
1000	2-3 h	Face blurriness, possibility of coma and seizure
2000	1-2 h	death

Methane (CH<sub>4</sub>) is the second important gas accounting for about 20% of greenhouse effect (reflection), whose atmospheric concentration is around 200 times lower than that of carbon dioxide [24]. In any case, every methane molecule is about 20 times more potent than carbon dioxide molecule to absorb infrared radiation. After entering the atmosphere, it survives there for about 8-11 years. Furthermore, its chemical properties influence the climate indirectly through affecting the atmosphere ozone and water vapor of the stratosphere [25].

Nitrous oxide (N<sub>2</sub>O) is responsible for about 6% of the greenhouse effect (radiative forcing), and its ability in absorbing infrared radiation is 300 times as large as that of carbon dioxide [26]. In other words, one molecule of N<sub>2</sub>O equal to one molecule of CO<sub>2</sub> decreases the potential of passage of light reflected off the earth. This gas usually enters the atmosphere through the nitrification process in the nitrogen cycle. Oceans, soil, combustion of fossil fuels, biomass burning, use of nitrogen containing chemical fertilizers in the agriculture, and different industrial processes are among the most important natural and human-borne sources of production and liberation of nitrous oxide in the atmosphere. After photolysis (photochemical processes), N<sub>2</sub>O gradually enters the stratosphere from biosphere, and survives

about 150 years in the atmosphere. The concentration of this gas grows by about 0.2% each year [27].

Chlorofluorocarbons (CFCs) are molecules that contain chlorine, fluorine, and carbon. Unlike other greenhouse gases, these gases do not naturally occur in the atmosphere, and entered the atmosphere only through human activities. These gases significantly absorb the radiation reflected off the earth within a very thin band of 8-13 mcm [28]. Two members of this family, CFC-11 and CFC-12, are very important in terms of climate change. One molecule of CFC-11 and CFC-12 decreases the potential of passage of light reflected off the earth by 12000 and 16000 times as large as a single CO<sub>2</sub> molecule, thereby warming the earth. CFCs may account for over 20% of the greenhouse effect, except for 1996, whose value began to decline gradually. CFCs have the potential for enhancing the global warming as a greenhouse gas, and due to their extreme affinity to stratospheric ozone, they can also have a significant role in decreasing the level of ozone [29].

Tropospheric ozone (O<sub>3</sub>) exists both at ground level and in the stratosphere. However, its level in the stratosphere is 0.97 of the atmosphere ozone. Ozone in the troposphere does not have a long durability, but it has greenhouse effect in the atmosphere, which is comparable to that of other greenhouse gases, though its real reflective value is not known. This gas both absorbs the reflected longwave radiation and acts as a filter against the incoming radiation. Ozone is often a result of the activity of petrochemical refineries and biomass burning. There are signs suggesting that since the end of the 19th century, the ozone value has grown by two- to three-fold [30]. Although troposphere ozone is important for the greenhouse effect of the atmosphere, estimation of its global distribution and trend is very difficult due to its very unbalanced geographical distribution [25]. Ozone is effective for filtering radiation of ultraviolet waves at the wavelengths less than 0.3 micron. It can absorb long wave radiations within the bands of 9.5-10.6 mcm in the atmosphere [31].

## Water and soil pollution

Pollution can enter water from different sources and ways. Regardless of the cause of development of pollution, we consider water as polluted when the level of external substances present in water is so large that its usage causes incidence of harmful effects in different ways. Any material and object that prevents natural use of water is considered water pollutant [9,32-34].

The general classification of sources that pollute waters: pollution of waters can be categorized into pollution resulting from wastewater, industrial wastewater, agricultural wastewater, and other pollutants. This classification encompasses a wide range of polluting sources, which can include production, industrial, mineral, animal husbandry, service, agriculture, refineries and power plants, complexes, administrative companies, etc. Each of them pollutes a significant volume of water resources due to not following environmental principles and neglecting the relevant rules and regulations. Presence of mercury compounds in water causes toxicity of aquaculture. Also, when these animals feed on this

element, it causes severe nervous disorders, reproducing defective children, severe pain, and death. Excessive amounts of fluorine in water causes yellowing of teeth and development of bending in the bones. Presence of nitrate and nitrite in water causes diminished oxygenation capacity in the body. Drinking hard waters results in development of digestive disorders. Burnt automobile oils are regarded as the worst and strongest environmental pollutants, such that one liter of used oil can pollute 1 million L of healthy water, making it unusable.

Water pollution through agriculture has been one of the great issues in advanced countries at least for 25 years. Acceleration of erosion and discharge of nutrients into rivers, leaching nutrients and pesticides into groundwater, as well as contamination of surface and ground waters by bacteria are some of the aspects of the effect of modern agriculture on the environment. Some methods have been developed to tackle these problems, many of which such as protective plowing are associated with erosion control. The factors that affect water quality include plowing, fertilizer consumption, use of pesticides, manure, and irrigation management. The major effect of protective plowing systems is keeping the maximum plant residues on the soil surface. In conventional plowing systems, the amount of plant residues at the time of cultivation is zero, while in the system with chisel plow; it is about 50 to 70%. In strip plowing, it is 30 to 60%, and finally in plow-free systems, it is 50 to 90%. The environmental problems related to irrigation of farming lands have a long history. Saltiness is the most important problem of water quality with regards to irrigation, affecting about one-third of water lands. The important factors that pollute water in response to agricultural activities are water pollution by fertilizers, water pollution by agricultural chemicals, and water pollution in response to animal husbandry and fisheries activities.

Soil pollution is a ground on which the survival of millions of humans is dependent. Globally, after climate, soil is considered the third major component of the environment. Soils are a big saver of carbon: four times the atmosphere and three times the trees around the world. However, the world soils have lost 100 billion tons of carbon over the past 10,000 years in response to cultivation and deforestation. When the soil is plowed, roots and other carbon containing plants become exposed to air and oxidation by carbon dioxide. It is suitable for eliminating weeds, but it is at the expense of liberation of carbon. Soil pollution is typically a result of unhealthy habits, different agricultural activities, and wrong methods of discharging solid and liquid wastes. In addition, fall of air polluting factors in response to precipitations can also be involved in development of soil pollution. Soil becomes polluted in response to imprudence by chemicals including heavy metals and oil industry products, whereby it enters the food cycle, surface or groundwater, and eventually the human body. Among the different soil pollutants, the most important ones include biological and chemical contaminations [35]. As we know, discharging wastes results in soil pollution. On the other hand, production of wastes is a byproduct of industrialization. In the industry, given the extent of activity, type of technology used, the employed raw materials, and

existence of recycling systems, significant amounts of wastes are produced, whose management is vital environmentally.

In recent years, soil pollution resulting from usage of mineral compounds including Mercury, cadmium, lead, arsenic, copper, zinc, nickel, manganese, etc. has attracted a great deal of attention. Lead enters the atmosphere through gasoline combustion and motor vehicles and burning coal along with other human activities, and precipitates on soil during rainfall and snowfall. Heavy metals are present in the composition of organic fungicides, herbicides, and insecticides, causing soil pollution. Super phosphates and limestone typically have some cadmium, copper, manganese, nickel, and zinc, whose application may lead to soil pollution [36]. Waste refers to solid, liquid (apart from wastewater) and gas materials which are directly or indirectly a result of human activity, and is considered waste by the producer. In addition, deicing agent used for snow removal operations can cause soil pollutions. Chemical toxins enter the soil through their direct application in soil can increase contaminating rates of mineral compounds, thereby polluting the soil [37].

### Noise pollution

The indiscriminate growth of the population alongside industrial and technological development of Metropolitan cities has led to numerous problems for citizens, with environmental problems being one of them. One of the different types of contamination is due to the excessive noise in most working environments and our surrounding world, which we face them during the day directly. The damages of noise are mostly related to auditory and nervous systems, and can cause diminished work efficiency, reduced accuracy, and eventually possibility of accident. Noise pollution is directly related to industrial technology. In other words, concurrent with the growth and promotion of technology, noise problems also extend to more important problems. Human ears cannot hear all samples, and they only hear the sounds within the frequency range of 20-20000 Hz. The frequency of conversations is usually 500-2000 Hz. the sounds with a frequency of lower than 20 Hz are called subsonic, while those above 20,000 Hz are called ultrasonic [38]. Sound refers to the wavelengths generated in response to vibration of objects or materials including solids, liquids, and gases. Noise pollution refers to emission of any sound or noise or vibration larger than the allowable and established limits in the open air, **Figure 1** shows typical outdoor sound measured on a quiet suburban street.

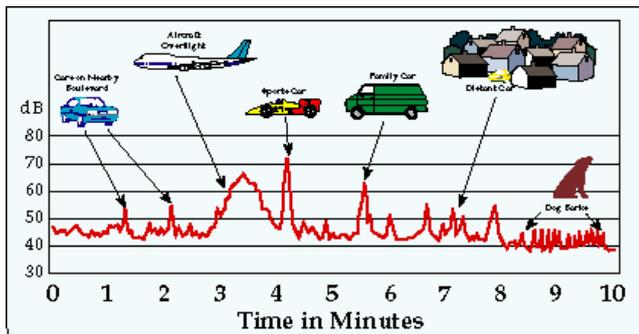


Figure 2. Typical Outdoor Sound Measured on a Quiet Suburban Street

Figure 1 Typical Outdoor Sound Measured on Quiet Suburban Street [39].

generations, it minimizes the effects of economic activities. When the current crucial and essential activities incur costs to the future generation, these incurred damages should be compensated for completely. In other words, sustainable development should have a special emphasis on the welfare of the poor and provides the possibility of improving the public life level. At the same time, it should prevent incurrance of irrecoverable damage to the future generations [40]. Development should be considered a multidimensional movement and a compound and complex process; a process whose realization necessitates fundamental changes in social construct, the public attitude and national institutions, alongside fast economic growth, reduction of inequality, and eradicating absolute poverty. In other words, this process cares for both enlargement of production dimensions and improvement of production quality. Sustainable development requires establishing a suitable balance between economic, social, political, and environmental dimensions. Therefore, the environments and dimensions of sustainable development include natural, economic, social, political [41]. **Table 2** presents the history of sustainable development as well as the strong and weak points of each definition.

## Results and Discussion

The socioeconomic development should be realized such that at any time when a cost is incurred to the future

Table 2 Evolution of the issue of environment in development plans.

development plan	strong points	weak points
First plan 1989-1993	Incorporation of only one note in the entire plan to control environmental degradation for the first time	Implementation of only three systematic plans; the qualitative environmental objectives of the development plan (lacking quantitative objectives); lack of provincial environmental objectives
Second plan 1995-1999	Development of environmental articles of the plan under the effect of Rio conference (1992); incorporation of quantitative environmental objectives in the plan; extensive attention to international understandings, provincial environmental plans, development of the national committee for sustainable development in the plan	Low absorption of the approved budget predicted for environmental plans (more extreme degradation of environmental dimensions in the country compared to the beginning of the period)
Third plan 2000-2004	Developing the multi-sectoral committee for implementing environmental plans, extensive attention to the role of public participation in public education in the plan (elevating 156 nongovernmental organizations to about 600), adopting preventive policies instead of passive policies in the plan, allocating a separate chapter in the plan to the issue of the environment	Lack of suitable executive mechanisms and guarantees to accomplish the plans
Fourth plan 2005-2008	Alignment of the plan with the provisions and documents supporting the twenty-year perspective (horizon 1404), developing the multi-sectoral document for the environment, allocating a separate chapter to the environment	
Fifth plan 2009-2014	Relative preservation of the strong points of the fourth development plan	Diminished attention to the environment (in terms of the number of quantitative articles and provisions), generalizations, and lack of measurability in some of the environmental provisions in the plan

In summary, sustainable agriculture has been a type of agriculture in favor of human benefits. It has greater efficiency in the use of resources and is in balance with the environment. In other words, it is suitable ecologically, justifiable and economically, and desirable socially. It uses methods for

sustainable agriculture to reduce contamination of natural resources. They include:

### Organic agriculture

The first organic agriculture method is agroforestry, in which trees and crops are planted concurrently, which is common in

many parts of the world. The agroforestry systems are especially of interest in warm regions. Agroforestry has greater potential than other farming systems in terms of both ecology and farming. In this system, the wind and water movement declines and soil erosion is minimized. The trees modify atmospheric conditions by reducing the temperature; they absorb the air and redistribute it in soil. The second method is to combine live-stock and plants, in which the live-stock is kept in the farm, where after harvesting the product, the live-stock can graze and use manures to strengthen the plant. Here, the plant can be produced naturally in the farm. The third method involves mulching. Mulch refers to covering the land with plant remnants, plastic, sand, etc. to prevent growth of plant around the main products including railway. One of the mulching methods is live mulch which refers to cultivating a mixture of a low-growth plant. It is a coverage which is known as live mulch and is able to control weeds of a summer one-year forming plant such as soybean or corn.

### Controlling weeds

The methods for controlling weeds include cultivars competitable with allelopathic or both, use of remnants of Allelopathic plants as mulch and mixed cultivation systems. In this way, the competitive power of forming plants grows or develops for a long time in the growth season. The difference between forming plants in competition with weed of herbicides may be attributed to production of Allelopathic inhibitor materials by the roots and their living aerial parts. The cultivars that produce more Allelopathic materials can better compete with weeds.

### Biologic control

With the help of many herbivore insects or insects that are parasite to other insects, one can combat many pests naturally. One successful example has been Trichogramma bees in the North. These products have developed a plant resistant to pests through transferring the genome resistant to a disease or pest via a plasmid or protozoan virus, thereby decreasing the need to toxins. On the other hand, while increasing group environmental cleanness, it is against it, which is attributed to the fact that the inoculation of transgenic plants and sibling weeds, a weed with abnormal properties may emerge. In other words, a super-weed is created, and in that case typical methods will not be possible to remove them.

### Alternation

Alternate planting of plants which have different abilities in terms of absorbing nutritional elements from the soil or have different rooting system, alternate planting of plants sensitive to some diseases with those that are resistant to these diseases, a planned sequence of cultivating plants whereby any positive and negative effect of a plant has been taken into account on the plant which is cultivated after it, sequential cultivation of plants that have different needs in terms of workforce, water, etc., Sequential cultivation of plants that

discharge the soil's nutritional storage with those that contribute to supplying the soil nutrients.

Periodicity has different characteristics. Soil fertility when chemical fertilizers did not exist yet, stabilization of nitrogen, and consumption of manure were the only way for soil fertility. Today when chemical fertilizers are abundant and inexpensive, while the costs of cultivating and maintaining Leguminous plants as green fertilizer have increased significantly, large consumption of fertilizers causes increased amount of plant remnants, which can be buried beneath the soil.

Preventing accumulation of soil-borne diseases, pests and weeds result in less consumption of toxins. Controlling soil erosion: stubble mulching resulting from the previous product or cultivating plants that reduce the need for ploughing such as alfalfa are useful. Inter-cropping: this means use of a farm for producing two or several crops in a year. These methods can be employed for sustainable agriculture.

### Conclusion

In this study, some of the most important environmental contaminations were introduced. Contemplating on what has been said; the following suggestions can be presented as conclusion for combating environmental contaminations.

- Enhancing the technology of vehicles to improve the status of emission of pollutants.
- Using suitable public transportation to reduce usage of personal vehicle.
- Retiring old vehicles.
- Suitable management of traffic of cities.
- Notifying and enhancing the awareness of people.
- Impugning vegetation. Insulating buildings.
- Employing double glazed windows and medium lattice walls and developing the green space as important solutions for preventing entrance of harsh noises into houses.
- Isolating and separating normal or industrial wastes from hazardous waste.
- Collecting garbage and waste in a way that hazardous chemicals are not mixed with industrial waste.

Employing suitable waste collection techniques such that it becomes as dense and low-volume as possible. All production industrial units should collect and label wastes inside suitable initial containers separately considering the volume and properties of the wastes to recycle or keep them in temporary warehouses. The stores containers should be designed such that they can be collected in a mechanized way. The landfill site should have a collection system for surface water. Including suitable methods for water treatment.

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