



e-ISSN: 2456-6632

This content is available online at AESA

Archives of Agriculture and Environmental Science

Journal homepage: journals.aesacademy.org/index.php/aaes



REVIEW ARTICLE



A review on the role of emerging anthropogenic activities in environmental degradation and emphasis on their mitigation

Aditi Bisht¹ , Nitin Kamboj^{1*} , Vishal Kamboj¹ and Akanksha Bisht²

¹Department of Zoology and Environmental Science, Gurukula Kangri Vishwavidyalaya, Haridwar - 249404 (Uttarakhand), INDIA

²Department of Medicinal and Aromatic Plants, High Altitude Plant Physiology Research Centre, Hemvati Nandan Bahuguna Garhwal University, Birla Campus, Srinagar - 249161 (Uttarakhand), INDIA

*Corresponding author's E-mail: kambojgurukul@gmail.com

ARTICLE HISTORY

Received: 15 July 2020

Revised received: 16 September 2020

Accepted: 22 September 2020

Keywords

Anthropogenic causes

Environmental degradation

Land degradation

Soil pollution

Water degradation

ABSTRACT

Environmental degradation is the deterioration of natural resources such as air, water, soil, flora, fauna, and all other living and non-living component of the planet earth. There are two main reasons for environmental degradation i.e. anthropogenic causes like industrialization, overpopulation, deforestation, mining, etc. and natural causes like flood, landslide, desertification, temperatures, etc. Nowadays, the demand for natural resources is increase due to the exceeding population. To fulfill the demand of humans, over exploration of the natural resources in carrying out, due to this they are under pressure. The anthropogenic activities disturbed and degraded the environmental component such as the atmosphere, hydrosphere, biosphere, and lithosphere. All the environmental component is linked together if one is disturbed than its disturbed the other one also. However, in this paper, we discussed the anthropogenic activities that affect the environmental component directly or indirectly and we also suggested the recommendation and mitigation measures to sustain the environmental component developed by the agencies and policymaker.

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Citation of this article: Bisht, A., Kamboj, N., Kamboj, V. and Bisht, A. (2020). A review on the role of emerging anthropogenic activities in environmental degradation and emphasis on their mitigation *Archives of Agriculture and Environmental Science*, 5(3): 419-425, <https://dx.doi.org/10.26832/24566632.2020.0503025>

INTRODUCTION

The environment is interaction and adaption to physical, chemical, and other natural forces. The interaction is among animals, plants, soil, water, and other living and non-living things in the environment (Johnson *et al.*, 1997). The accessibility and utilization of natural resources have an orientation on the result and the pace of the improvement process. In society, most of the conditions are man-made created by the man using natural resources (Mirski *et al.*, 2017). The sustainable management of natural resources is elementary for money related advancement and human prosperity. The world's natural networks deal with the air, water, and soil on which we all depend. They outline an exceptional and down to earth support against remarkable atmosphere events and environment change (Warner *et al.*, 2010). Sound natural frameworks are essential for the long stretch improvement of monetary territories, for instance,

agribusiness, fisheries furthermore, the travel industry. About 60 to 70 percent of the world's environments are demeaning quicker than they can recover (Rambabu, 2018). There are numerous natural issues in India. Air contamination, water contamination, trash, are some of the major challenges in India. The conditions were more terrible between 1947 to 1995. According to data collection and assessment of World Bank, done between 1995 and 2010, India has improved a lot in terms of improving its biological quality but still, there is much more to be done to reach the level of developed nations. Degradation on the environment is some of the essential drivers of infection, medical problems, and long-term livelihood impact for India (Huesemann and Huesemann, 2011).

Environmental degradation can be characterized as the disintegration of the ecological framework because of human intervention (Chertow, 2001). It can have genuine impacts for some, animals, plants, and mankind (Figure 1). Therefore, to

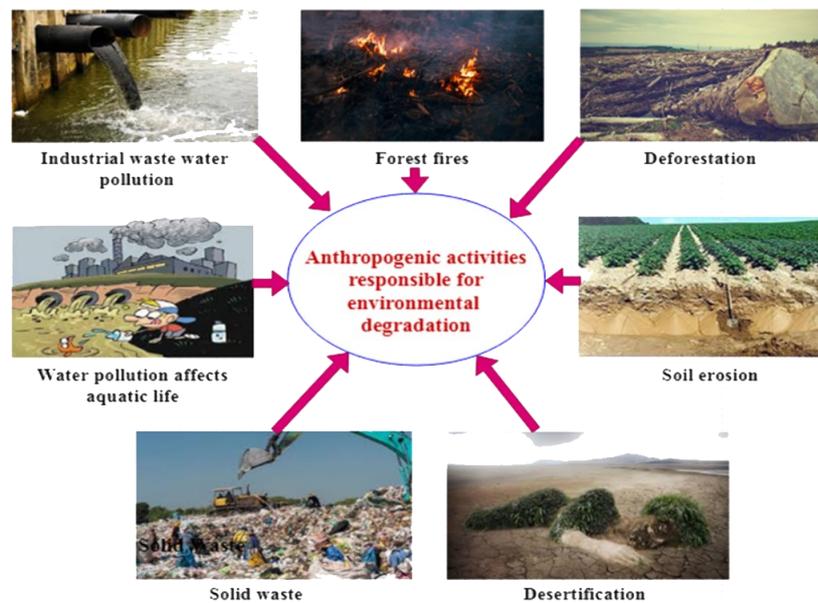


Figure 1. Environmental degradation by different activities.

anticipate these antagonistic outcomes, we should take a few measures in our day by day life. So, keeping this view we discussed the various anthropogenic activities that are responsible for degrading the environmental component such as the lithosphere, biosphere, hydrosphere, and atmosphere. Although, in this paper, we discussed the recommendation and mitigation measure for conserve the environmental component in a sustainable manner which is developed by the government agencies and policymaker.

TYPES OF ENVIRONMENTAL DEGRADATION

The progressive exploitation of the environment is because of numerous factors. There are mostly three distinct sorts of ecological degradation (Kuamr *et al.*, 2019). They are land degradation, water degradation, and air degradation. The degradation of these three situations impacts the global atmosphere and living conditions (Warner *et al.*, 2010). All the environmental elements are dependent on each other and the degradation of one kind prompts the breakdown of other factors in nature.

The primary driver of environmental degradation is human exploitation. Even though nature has its specific manner of degradation it re-establishes the earth also making it increasingly vulnerable for different living things. Humans have affected the earth in a quick and injurious way, a restoration from which cannot stay up with the pace of degradation (Akbulut, 2014).

Degradation is commonly divided into three types (Figures 2 and 3).

- Land and soil degradation
- Water degradation
- Atmospheric degradation

LAND AND SOIL DEGRADATION

Junk and garbage are a typical sight in urban and rural territories

of India. It is a significant source of contamination. Indian urban areas alone create more than 100 million tons of solid waste a year. Cities are heaped with garbage. Open spots and walkways are pillaged with litter, rivers, and trenches also act as landfills. The nature of the soil is very significant for some plants and microorganisms. Although, because of human intervention, the soil gets contaminated to a genuine degree (Ragab and Prudhomme, 2002). For instance, through cultivation, an extreme quantity of fertilizers and pesticides are utilized. Pesticides regularly contain dangerous components that can pollute the soil. Besides, numerous landfills have pores that contain harmful substances that enter the soil horizon and contaminate it. Nevertheless, increments in CO₂ discharges, industrialization has expanded the measure of nitrogen deposition. Nitrogen deposition from human exercises may help forests that are nitrogen-constrained, yet abundant nitrogen can prompt soil acidification ion and decreased supplement accessibility to plants (Ragab and Prudhomme, 2002).

Causes of land and soil degradation

The reasons behind the land degradation can be isolated into natural hazards, man-made hazards i.e. direct causes, and underlying causes (Kamboj *et al.*, 2020). In naturally hazardous conditions, land degradation is happened due to the water erosion and steep slope of the land or soil. Besides, man-made land degradation is based on two factors such as direct and underlying factors. Direct factors are generally affecting the land by improper used and management of the land. In underlying practices, land degradation has been happened due to improper land-use practices (Kumar *et al.*, 2015). For example, due to lack of food, more agriculture practices are done on the steep slope without any soil conservation practices (Stocking, 2005). However, here we will discuss major anthropogenic causes that come under direct and underlying factors.

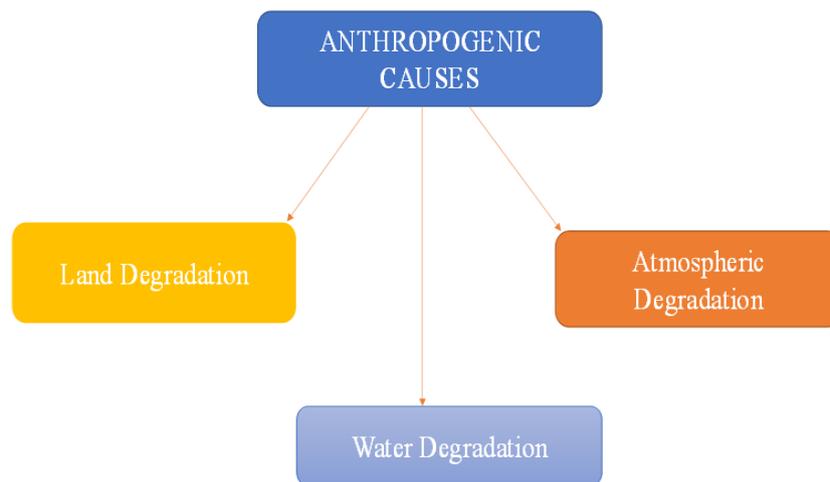


Figure 2. Classification of anthropogenic causes for environment degradation.

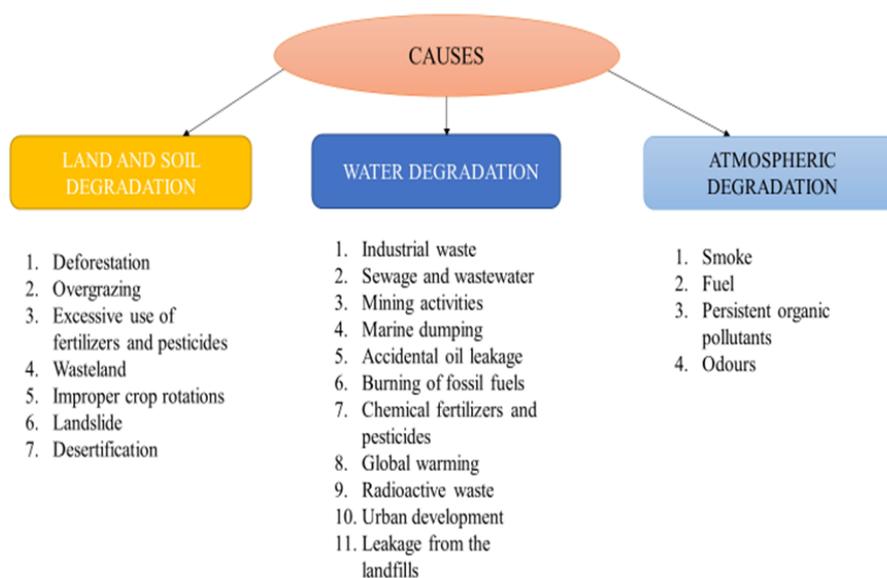


Figure 3. Causes of environmental degradation.

Deforestation

Forests assume a significant job in keeping up the fertility of the soil by shedding their leaves which contain abundant supplements. Forest helps in binding the soil particles together with their roots. Hence, cutting of woods will influence the soil antagonistically (Oral, 2020). Deforestation may not be the main reason, as most productive land would not be available in the forest were not cleared. But deforestation becomes a problem when land is cleared without knowing its significance example steep slope, erodible land, etc. and it is not managed properly. Deforestation also causes water erosion on slopes, wind erosion, the decline in soil fertility, and soil salinity. According to the Ministry of Environment and Forests (MOEF), Arunachal Pradesh has cleared the most forests, followed by Madhya Pradesh and Andhra Pradesh over the last 30 years.

Overgrazing

Increment in animal population brings about overexploitation of fields. Because of this, grass and different kinds of vegetation can't endure and develop in the territory, and the absence of vegetation spread prompts soil erosion. It leads directly to

decreases in the quantity and quality of the vegetation cover. A large number of individuals in Africa and Asia raise creatures on fields and rangelands that have low carrying capacity as a result of low-quality precipitation pastoralists and their rangelands are undermined by overgrazing. This is the foremost reason not only of wind erosion but also of water erosion in drylands. Both degradations of the vegetation cover and erosion lead to a decline in soil organic matter and physical properties, and hence in resistance to erosion.

Excessive use of fertilizers and pesticides

Fertilizers are essential for growing productivity of crops but their unnecessary usage has prompted abundant worry as a probable environmental risk. Extreme usage of fertilizers is producing a disparity in the number of certain nutrients in the soil. This disparity badly disturbs the crop (Kamboj et al., 2016). The temporary solution of improving the fertility of the soil by only applying macronutrients, and predominantly nitrogenous fertilizer, which is creating a larger problem of nutrient unevenness in the average span. The result of it may be extended crop responses to fertilizer.

Wasteland

The ecologically inappropriate, economically unproductive, and environmentally deteriorated land is termed as wasteland. It has been estimated that half of our country is composed of the wasteland. It is generally of two types. First is a cultivable wasteland that is accessible for farming, but is not cultivated for few years due to some reasons example waterlogged land, marsh, etc; and uncultivable wasteland is where farming cannot be practiced for example rocky areas, steep slopes, etc. In 2016, the largest wasteland was in Jammu & Kashmir followed by Rajasthan, Madhya Pradesh, and Maharashtra.

Improper crop rotations

As the population is increasing the farmers have to fulfill the need for more people, but there is a shortage of land and economic pressures. The farmers have to achieve more demands so they have adopted cereal-based, intensive crop rotations, based chiefly on rice and wheat, instead of the cereal-legume rotations that were previously used. This is a contributing reason for soil fertility deterioration (Boincean and Dent, 2019).

Landslide

The abrupt movement of the mud and rock ejected from the slope due to gravity is called a landslide. They can be commonly seen in hilly regions especially near the river banks. The flowing water disturbs the surface and erodes the soil causing a landslide. In India, this phenomenon is common in north and north-eastern areas (Hidayat, 2019). But landslides can be natural as well as manmade. The landslide induced by the human can be due to deforestation, extreme mining in hilly areas, the building of dams, infrastructure, and transportation.

Desertification

Desertification is the most concern problem all over the world due to the combined impacts of the human activities and also by the natural drought that disturbed the ecosystem of sub-humid, arid, and semi-arid regions (Miao et al., 2015). In recent decades, the desertification is a serious problem for the ecosystem as well as it creates the socio-economics problem. Besides, in many regions, it has been noticed that agricultural productivity and nutrition value of live stocks is less, reducing in vegetation biomass, decrease in species diversity, and their composition and water shortage (Hansen, 2010; Miao et al., 2015). The condition of the desertification is happened due to the human activities such as over exploration of the natural resources, pollution that creates the climatic problems, unsustainable way of agricultural practices that directly affect the soil quality and absorption process of the soil or land (Meng et al., 2020).

WATER DEGRADATION

Water degradation also known as water pollution is chiefly caused by the release of harmful materials into water bodies interpreting it unsuitable for the use. Numerous manufacturing industries dump their wastes into rivers, lakes, ocean, and sea.

These wastes are frequently untreated and comprise harmful chemicals that can be deadly to aquatic life forms and humans as well (Hayek and Al Hmoud, 2011). Chemicals used in fertilizers and pesticides contaminate the water bodies after rainfall. Oceans are also affected by the refuse and waste discarded by the people living near the shore and the ships and streamers which create a threat to marine life (Arif, 2010).

Causes of water pollution

Industrial waste: Industries yield a vast quantity of waste which comprises deadly chemicals and pollutants such as lead, mercury, sulphur, asbestos, nitrates, and many other harmful chemicals (Sarin and Pant, 2006). Some industries do not have an appropriate waste management unit and the waste generated is generally disposed of in the water body. This phenomenon generally causes eutrophication, change in colour and temperature which causes serious damage to living beings mainly fish fauna (Nemerow and Dasgupta, 1994; Sharma et al., 2018).

Sewage and wastewater: The wastewater and sewage are treated by chemicals produced by household and later released into flowing water. These chemicals and bacteria in the water body increased the nutrient level that affects the quality and quantity of organisms and also it creates harmful health problems. Microbes are a source of some very lethal diseases and develop the breeding grounds for other beings that act as carriers (Jelic, 2011; Kumar et al., 2020).

Mining activities: Mining is the process of extracting minerals, coal, rocks, and pebbles from the riverbank, underground (Kamboj et al., 2017). The mining of raw materials is very beneficial to increase the country's economy. The mining of river bed materials, coal, petroleum, and other metals directly affects the environmental component (Salomons, 1995). These materials when mined in the raw form consist of a harmful substance, which mixes with water and increases its toxicity and also affects the aquatic biodiversity (Tiwary and Dhar, 1994; Hanson, 2010; Kamboj and Kamboj, 2019). Some studies are reported that sand and gravel mining directly affect the water quality, abundance, and diversity of aquatic organisms such as zooplankton (Kamboj and Kamboj, 2020).

Marine dumping and oil spills: The waste such as paper, plastic, rubber, aluminum, glass is collected and dumped into the ocean in few countries. These things take many years to decompose which contaminate the water bodies (Leitzell, 1972). However, oil spills are a process of oil leakage or discharge of oil in the water body due to the accidental or leak in oil transport ships, drilling in oceans and mostly the oil comes from the drainage from cities, industries, and unregulated boating. The oil does not mix with water but it creates a layer on the surface water. This layer is don not pass the sunlight into the water that poses a serious problem for the water cycle process and also aquatic organisms and local life (Al-Yasari et al., 2017).

Burning of fossil fuels: The fossil fuels are the non-renewable resources, which are essential to humans for transportation, electricity production, manufacturing of various chemicals and plastics. In the last few decades, the demand and consumption of fossil fuels are high in the whole world. The higher demand for fossil fuels directly affects the atmosphere, water ecosystem, and also the land ecosystem. When fossil fuels are burnt than they produced ash and different type of gasses (Allen et al., 2012). When water vapour is mixed with ash and gasses cause acid rain which contains lethal chemicals. This acid rain when falls in the water ecosystem than it directly affects the quality, flora, and fauna of the water ecosystem (Marland et al., 1985).

Chemical fertilizers and pesticides: Pesticides and fertilizers are necessary for plant growth which are used by the farmer to enhance the growth and protect the crop from insects and pests. Nevertheless, during rain chemicals of these fertilizers are used in the field mix with rainwater and flow to nearby water bodies (Sharma and Singhvi, 2017). In modern times, farmers are dependent on pesticides for increasing productivity. These chemicals increase crop productivity but create many adverse effects on humans as well as biota such as birds, amphibians, bees, and all others. These pesticides affect the human nervous system that creates the cancer problem. Some pesticides are not digestible, they persevere in soil and contaminate the surface water as well as groundwater through leaching (Nayak et al. 2020).

Global warming: Global warming or climate change is a result of the increase in earth temperature due to the greenhouse effect. High temperature raises the water temperature posing danger to aquatic beings which leads to their death (Houghton, 2009). It has several adverse effects on the human being such as heat-related diseases, economics decrease, spread the disease like malaria, yellow fever, dengue, in flora like decrease the photosynthesis process, chlorophyll content and also affect the agricultural productivity through an increase in drought condition, flood, etc (Maurya et al., 2020).

Radioactive waste: Nuclear energy uses Uranium by the process of nuclear fission or fusion. Waste produced after the reaction need to be disposed of properly to prevent contamination (Lutze and Ewing, 1988). In some countries, radioactive waste is disposed into the oceans. Sometimes, the waste is not properly disinfected than it creates a serious problem for the aquatic organisms.

Urban development: Due to population growth, the need for food water, house, and cloth has also increased. To fulfill the basic needs fertilizers are used to produce food, deforestation is carried to create land for house and wood for construction activities, land for garbage is developed, and many chemicals are used in the industries for more production (Henderson, 1991).

Leakage from the landfills: The garbage is heaped in landfills which produce harmful chemicals and smell. These chemicals seep in the ground and contaminate the groundwater Babonea and Joia (2012). The contamination makes the groundwater unfit for drinking (Lee and Jones-Lee, 1994).

ATMOSPHERIC DEGRADATION

Air pollution is causing atmospheric degradation. This is also one of the reasons for global warming. The increasing air pollution has led to various health risks including climatic changes all over the planet. The impact of air pollution has a chain reaction causing the breakdown of other ecosystems as well. There are numerous natural activities like volcanic eruptions, floods, earthquakes, wildfires, storms, etc that cause environmental degradation (Atkinson and Arey, 2003; Kamboj et al., 2020). The main anthropogenic cause for air pollution is the burning of fossil fuel, and the release of harmful gases like carbon monoxide, carbon dioxide, sulphur dioxide, nitrogen oxides, and hydrocarbons from industries. All these gases are damaging to the atmosphere. Carbon dioxide is the main greenhouse gas for global warming. The acidity of the ocean is also increased due to the high concentration of carbon. Carbon monoxide is released by a vehicle that combines with haemoglobin which is very deadly to human health (Kampa and Castanas, 2008).

Causes of air pollution

To comprehend the reasons for Air contamination, a classification is made. There are commonly two types of pollutants i.e. primary pollutant and secondary pollutant. A primary pollutant is those which are discharged directly from the source whereas secondary pollutant is produced when primary pollutant reacts with the atmosphere. Natural sources of the pollutant can be in the form of smoke from the volcano, dust, etc. but here we will discuss man-made causes. While observing at the man-made contributions towards air contamination.

Smoke: Smoke again features as a protruding component. The smoke radiated from different types of ignition like in biomass, manufacturing plants, vehicles, heaters, and so forth. Waste used to make landfills create methane, which is unsafe in different ways (Bader, 1991). The responses of specific gases and synthetic compounds additionally structure vapour that can be risky to the health of living animals (Mulholland, 2002).

Fuel: The consumption of non-renewable energy in fuel sources is one of the single biggest reasons for air pollution. Coal and oil are commonly used for heating, producing electricity, cooking, transportation, and another industrial process (Blumer and Sass, 1972). Consuming these energizes causes brown haze, acid rain as well as ozone depletion (Oasmaa and Czernik, 1999).

Persistent organic pollutants: Persistent Organic Pollutants or POPs are a cluster of lethal chemical mixtures that can be transported through air and water. They are considered as a global concern as they can disturb the environment unfavourably (Jones and De Vogt, 1999). The more noticeable POP's is the Chlorofluorocarbons or the CFCs used in refrigerants, aerosol sprays, blowing agents for foams, etc. These molecules reach the upper layer of the atmosphere and breakdown into chlorine due to ultraviolet rays. These chlorine atoms reach the ozone layer and damage it (Wania and Mackay, 1996). Other POP's like dust sand and gravel which are produced due to mining and construction activities damages the atmosphere. These create smog and breathing disorder to the people. The excessive cutting of trees has reduced the fertility of the soil, increased soil erosion, and decrease of photosynthesis. The reduced amount of photosynthesis reduces the conversion of the detrimental carbon dioxide to oxygen. This causes more carbon dioxide trapped in the atmosphere which in turn causes global warming (Bernes, 1998).

Odors: The environment is not only degraded by the chemicals but by the odor or foul smell produced by them. Unhygienic living conditions and uncontrolled discarding of garbage lead to the foul smell that can depreciate the living surroundings in an area. It can not only make breathing problems it can also lead to illnesses and attract flies, bugs, and animals (Gostelow et al., 2001).

RECOMMENDATIONS FOR ENVIRONMENTAL DEGRADATION PREVENTION

Burdens on the environment will continue to grow as the worldwide population upsurge, incomes rise, and industries expand. It certainly produces unsuspected and possibly harmful environmental, monetary, and human health consequences. Environmental study has demonstrated its worth in helping to answer and prevent many complications, and it endures to be a sensible and essential investment. We can follow some suggestions for protecting the environment according to its nature (King, 2018). Land degradation can be mitigated by using the following points such as Avoiding deforestation activities in the hilly areas. This can generate a remarkable way of redesigning and restoring forests and undergrowth. To bring back the soil mineral and organic matter, it would land reclamation by adding plant residues and range management It requires actions for returning the lost organic material and important minerals. Salinized soils can be improved by salinity control which can be done by plantation of crops trees and flowering species on affected areas. Appropriate tillage also known as conservation tillage practice is the greatest sustainable way of preventing soil quality decline. Besides the Basic protection practices for water degradation are as follows: removing the pollutant by treating through biological, chemical, and physical processes eliminate the pollutants from the water. Climate-friendly crops should be planted to reduce the demand for irrigation and fertilizer. Storm

management can be done to reduce runoff. Air pollution should be controlled to reduce the acidification of our water bodies and threatens aquatic life and corals (Middleton and Rhodes, 1984). However atmospheric pollution can be reduced by clean energy like solar, wind and geothermal energy should be used instead of fossil fuel. Green buildings should be promoted to reduce carbon footprint and to develop resource-effective constructions. Eco-friendly transportation should be promoted by carpooling, using an electric vehicle, and public transportation. Reduce consumption of energy by adopting responsible habits (Wang, 2019).

Conclusion

For a few decades, the most concern problem is the degradation of environmental components such as the lithosphere, hydrosphere, biosphere, and atmosphere due to the anthropogenic activities. Humans are depended on natural resources for fulfilling their daily needs. The main reasons for the degradation of the environmental component are the fast-growing population and excessive use of natural resources. The excessive use of natural resources causing air, water, and noise pollution together with the scarcity of resources. Solutions to this problem might comprise re-envisioning the proper use of resources and finding better renewable resources. If we do not act soon our resources and environment will degrade and will leave is with nothing. This is a no inevitable scenario, however, with few sustainable measures and shifting towards a green economy we can protect our environment from ruins.

ACKNOWLEDGEMENT

The authors highly thank the Department of Zoology and Environmental Science, Gurukula Kangri Vishwavidyalaya, Haridwar (Uttarakhand) for providing the facilities for this work.

Conflict of Interest

There is no conflict of interest.

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