Impact of Human Factors on Nature and Corresponding Measures

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Abstract. As people in nowadays are paying more and more attention on environmental problems, we have noticed that human factors are great contributors to many problems on nature. This essay mainly discusses about the effects of human factors on nature in the aspects of atmosphere, rivers, oceans, and soil. In the paper, various of human factors including burning fossil fuels, sewage disposal, etc. are studied. Industrial processes emit significant greenhouse gases, disrupting Earth's balance and contributing to global warming and acid rain. Sewage and improper waste disposal in rivers and oceans turn once-pristine waters toxic, imperiling marine life. The urgency to address disposal habits is evident in cases like turtles ingesting plastic bags. Plant life is also affected as sewage laden with nitrogen, phosphorus, and potassium leads to ecological degradation, causing algal blooms and creating "dead lakes" or "dead seas." On land, human activities like desertification, deforestation, and urbanization have degraded soil health. Additionally, past imprudent infrastructure development has left scars of mudslides, emphasizing the vulnerability of ecosystems to human disregard. Lastly, the paper discusses some possible solutions due to this situation. This paper hopes to find out ways to solve environmental problems caused by human factors.

Keywords: Human factors; global warming; marine life; ecosystem; solutions.

1. Introduction

The purpose for this research paper stems from a growing recognition of the substantial environmental consequences arising from human activities. As society becomes increasingly cognizant of the widespread pollution affecting diverse environmental realms, the paper aims to concisely delineate the primary human factors that contribute to these severe environmental repercussions. These factors encompass the atmosphere, rivers, oceans, and land. By pinpointing these contributors, the research endeavors to offer a brief yet comprehensive overview of the intricate pathways through which human actions precipitate environmental harm.

Researchers worldwide are actively investigating the impact of human activities on the environment. Despite the abundance of research in this area, information remains scattered across various studies. This paper consolidates and interconnects data from different researchers, aiming to provide a more unified perspective on the human effects on nature. While solutions to environmental issues are available, their implementation requires time and collaborative efforts from individuals, governments, and scientists. The paper emphasizes the existing solutions but highlights the challenges involved in their widespread application.

This paper mainly analysis how human factors affecting the nature and discusses possible solutions to the problems proposed. First, this paper briefly introduces about the specific problems caused by different human factors or activities. Then, this paper gives several possible solutions to solve pollution problems in aspects of air pollution, water pollution and soil pollution. Also, listed some existing policies that are already implemented.

2. Human Impact on Atmosphere

Human factors including burning fossil fuels, cutting down forests and farming livestock are all factors that significantly affect the climate. Deteriorate the greenhouse gas emissions. The greenhouse effect, a phenomenon primarily induced by the excessive release of greenhouse gases, mainly carbon dioxide and methane, is a critical issue that has far-reaching consequences for our planet. These gases

accumulate in the atmosphere, forming a "greenhouse" that prevents heat or radiation from the sun from escaping from Earth. The "greenhouse" will reflect that heat back to the Earth's surface. This has led to rising global temperatures, increasing the frequency of extreme weather events, including heatwaves, hurricanes, etc. Fig. 1 is the greenhouse effect [1].

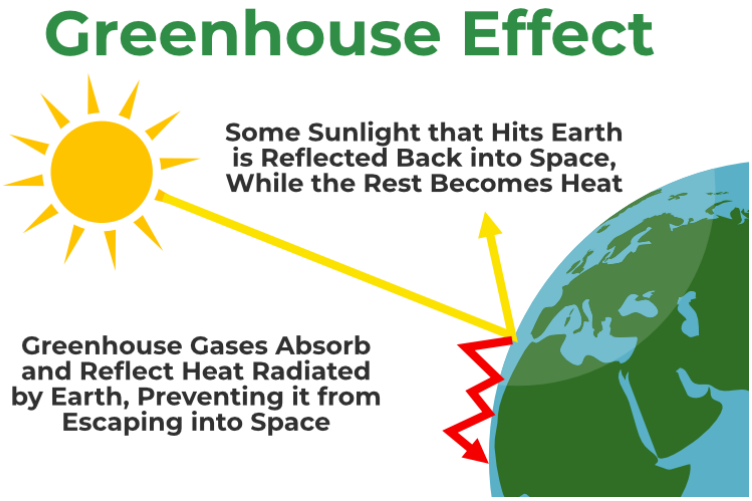


Fig. 1 Greenhouse effect [1]

Effect of burning fossil fuels. The burning of fossil fuels will produce a lot of carbon dioxide, methane, and nitrogen dioxide into the atmosphere. These gases, commonly referred to as greenhouse gases, create an effect that traps heat within the Earth's atmosphere, leading to a phenomenon known as the enhanced greenhouse effect. This results in a gradual warming of the planet, often referred to as global warming, with severe consequences for climate and ecosystems. Aside from greenhouse gases, the burning of fossil fuels releases a lot of other air pollutions, including sulfur dioxide, nitrogen oxides, and particulate matter. These pollutants especially sulfur dioxide, can lead to the formation of acid rain [2].

Effect of deforestation. Trees absorb carbon dioxide through photosynthesis, convert it into oxygen, and store it in wood and soil. However, once forests are cut down, this stored carbon will be released into the atmosphere. The process triggered by logging not only reduces the production of oxygen, but also leads to significant greenhouse gas emissions, including carbon dioxide, methane, and nitrous oxide [3]. This has had a direct negative impact on global climate change, accelerating the process of global warming. Forests also serve as natural filters, capable of absorbing harmful particles and gases from the atmosphere. However, deforestation has led to a reduction in vegetation, making it difficult to effectively remove pollutants from the atmosphere. This causes the air quality to worsen greatly, especially in areas that cut down a lot of trees.

3. Human Impact on Rivers and Oceans

A significant human factor affecting rivers and oceans is pollution. Industrial emissions, agricultural runoff, and improper waste treatment introduce pollutants such as chemicals, oil, and plastics into water bodies. These pollutants can have negative effects on water quality, harm aquatic organisms, and damage ecosystems. Overfishing is another key human factor affecting the health of rivers and oceans. Land use changes such as deforestation and urbanization can also affect rivers and oceans. Deforestation can increase river sedimentation, affecting the transparency and quality of water. Urban development often leads to an increase in impermeable surfaces such as roads and buildings, which can alter natural drainage patterns and increase runoff, bringing pollutants into water bodies. Human factors also lead to invasive species entering rivers and oceans. Through activities such as shipping and trade, non-local species can move to new areas where they may defeat local species in competition and disrupt the balance of ecosystems.

3.1. Animals

For example, the plastics. The disposal of plastics or polystyrenes by human can cause problems to ocean and water life. Each year there will be 12 million metric tons of plastic disposals into the ocean. Without the removal of plastic, the number of plastics in the ocean will exceed the number of fish in ocean in 2050 by estimating [4]. Fig. 2 is turtle trapped by plastics disposals [5].



Fig. 2 Turtle trapped by plastics disposals [5]

3.2. Plants

One main influence arises from the disposal of sewage and improper waste. The wastewater released contains high concentrations of nitrogen, phosphorus, and potassium. As these nutrients enter water bodies, they fuel excessive growth of algae, triggering algal blooms. This overabundance of algae disrupts the natural balance, impeding sunlight penetration and depleting oxygen levels in the water. Consequently, aquatic plants face increased competition for resources, leading to diminished biodiversity and even mass die-offs. Moreover, the proliferation of algal blooms contributes to the formation of "dead zones" in rivers and oceans, where dissolved oxygen levels are critically low or nonexistent. This oxygen depletion further exacerbates the challenges for plant life, hindering their growth and survival. The consequences extend beyond individual species, impacting the overall health and functionality of aquatic ecosystems. Plastic pollution compounds the problem, posing a direct threat to submerged plant communities. Improperly disposed plastic waste, often mistaken for food by marine life, can smother underwater vegetation and disrupt their photosynthetic processes. The persistence of plastics in aquatic environments poses long-term risks to plant populations and their associated ecosystems.

4. Impacts on Soil and Land

Human factors have a wide and profound impact on land, covering many aspects, from urbanization to agricultural activities, and then to industrial development. These impacts are becoming increasingly significant today, with significant impacts on the land environment. Firstly, urbanization is an important human factor that has exerted tremendous pressure on land. The expansion of cities has led to a large amount of land being used for residential, commercial, and infrastructure construction. This not only leads to a large amount of land consumption, but also leads to land fragmentation and damages the integrity of natural ecosystems. Urban expansion is often accompanied by large-scale land development, which may lead to environmental problems such as water pollution and soil erosion [6]. Second, agricultural activities have also had a significant impact on land. To meet the growing population demand, agriculture requires a large amount of land for

cultivation and animal husbandry. Excessive agricultural development may lead to soil impoverishment, land degradation, and ecosystem collapse. At the same time, excessive use of agricultural fertilizers and pesticides may lead to water pollution and have long-term impacts on land ecosystems [7]. Third, industrialization is also an important human factor that has had an undeniable impact on the land environment. Industrial activities are often accompanied by large-scale land development, pollution, and waste generation. The construction of chemical plants and industrial parks not only changes the natural state of the land but may also lead to land pollution and endanger the health of surrounding ecosystems. In addition, large-scale mining activities have also caused serious damage to land, leading to the depletion of land resources and the collapse of ecosystems [8].

4.1. Desertification

Land desertification refers to the process of gradual desertification and degradation of land that should have been covered by vegetation. Human factors have played a crucial role in causing land desertification, mainly including overgrazing, unreasonable agricultural practices, excessive logging, and urbanization. Desertification in fact leads to the loss of biodiversity and reduced food sources for animals. One notable trend is the expansion of arid and semi-arid regions. Climate change, characterized by rising temperatures and altered precipitation patterns, plays a crucial role in exacerbating desertification. Prolonged droughts and erratic rainfall contribute to soil degradation, making it more susceptible to erosion and nutrient depletion. As a result, previously fertile lands gradually transition into desert-like conditions. For example, desertification in China in 1950 to 1960 had increased from 53-thousand-kilometer square up to 114-thousand-kilometer square [9].

4.2. Mudslide

A mudslide, also known as mudflow, is a form of mass wasting involving fast-moving flow of debris and dirt that has become liquified by the addition of water. Human activities such as population growth, urbanization, and land development may affect the occurrence trend of debris flows. The impact of humans on the natural environment has increased the frequency and scale of debris flows. What's more, flooding caused by human deforestation can also cause disastrous flooding, particularly when landslide dams across streams are breached, and flooding may trigger slides [10, 11]. Fig. 3 is anatomy of a mudslide [12].

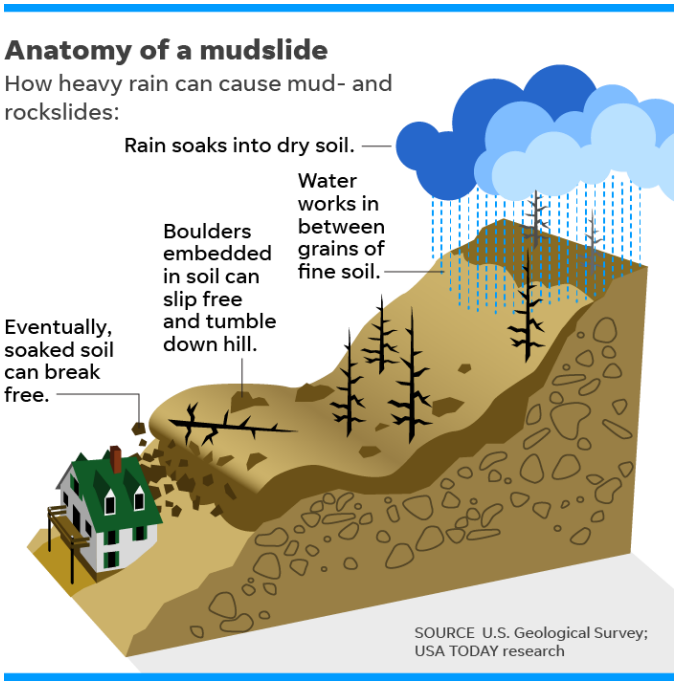


Fig. 3 Anatomy of a mudslide [12]

5. Measures and approaches

Taking action to reduce the impact on nature and the environment is crucial for several compelling reasons. Reduce climate changes. Human-induced activities, particularly the burning of fossil fuels, deforestation, and industrial processes, release greenhouse gases into the atmosphere, contributing to climate change. Taking action to reduce carbon emissions and transition to sustainable practices is vital to mitigate the impacts of climate change and reduce the global warming. Biodiversity Preservation. The diversity of life on Earth, known as biodiversity, is essential for the stability and resilience of ecosystems. Human activities, such as deforestation, pollution, and habitat destruction, contribute to the loss of biodiversity. Preserving nature helps maintain a balanced and thriving ecosystem, ensuring the survival of a wide range of plant and animal species. Resource Conservation. Earth's resources, including water, soil, and minerals, are finite. Overexploitation and unsustainable consumption patterns can deplete these resources, leading to environmental degradation.

5.1. Individuals

Individuals can reduce their air pollutions in several ways. First, avoid driving private cars and take public transportations like carpool or ride bikes. Individuals can also use fuel-efficient vehicles or even use electric powered vehicles instead. Ensure the maintenance of vehicles to optimize fuel efficiency and reduce emissions. Second, people can conserve energy and use less energy. To be more specific, people should turn off their lights or electronics when they're not in use. Also, people could advocate and support the use of renewable energy. Third, individuals can also plant trees and maintain green spaces. Since trees can absorb pollutants or greenhouse gases like carbon dioxide and they will release oxygen, contributing to improvement of air quality. Forth, people should also remember to recycle the wastes they produced and correctly classify the types of wastes and throw them into the correct bins.

Individuals can also reduce water pollution in several ways. First, dispose wastes properly, avoid littering and dispose wastes in designed bins. Trying to reuse or recycle trash as much as possible. Second, individuals should try their best to conserve water. People should fix leaks promptly to prevent water wastages. Individuals should use water-efficient appliances and fixtures. Individuals should also keep an eye on their daily water consumption. Third, individuals should avoid using harmful chemicals. To be more specific, individuals should us environmentally friendly and biodegradable products. Forth, individuals should be responsible for pet ownership, they should pick up pet wastes to prevent the spread of harmful bacteria into water.

Individuals can also reduce land or soil pollution in several ways. First, farmers should practice sustainable agriculture, they should support and purchase products from sustainable and organic farms. Second, reduce the usage of chemical fertilizers and pesticides, use natural alternatives instead. Since the usage of chemicals and pesticides may cause irreversible damage to the land. Third, proper waste disposal. All individuals should properly dispose their litters in the designed bins.

5.2. Governments

Governments should implement several policies to prevent air pollution. First, governments should establish and regularly update strict emission standards, encouraging citizens to use cleaner technologies and fuels. For example, the Cap-and-trade systems, this policy allows industries to trade emission allowances thereby incentivizing companies to recuse their emissions [10]. Second, governments should promote renewable energy. Governments should encourage the development and use of renewable energy sources such as wind, solar and hydroelectric power. Governments may also provide incentives and subsidies for renewable energy projects. Third, governments should invest more in public transportations, improve, and expand public transportation system to reduce people's reliance on private vehicles. Forth, governments should supervise and monitor the air quality. Governments should at least collect data about the air quality each day and provide real-time air

quality information to the public. Governments should invest in and maintain a good air quality as soon as possible.

Governments should implement several policies to prevent water pollution. First, governments should upgrade and maintain wastewater treatment programs to ensure the effective removal of pollutants. Second, governments should protect watersheds by establish buffer zones around the water bodies to prevent contamination; implement conservation measure to protect natural water sources. Third, governments should implement strict regulations to restrain the disposal of wastewater by factories. Monitor and ensure that no factories or industries can freely dispose sewage into lakes or oceans. For example, EPA implements TMDL policy, and also implement water quality trading to promote this policy [13].

Governments should implement several policies to prevent soil and land pollution. First, governments should promote organic farming by incentivizing and supporting the transition from chemicals and pesticides to organic farming practices; educate farmer on the benefits of soil conservation and sustainable land management. Second, governments can also collaborate with neighboring countries to receive ideas on pollution issues. Also, governments can participate in international agreements aimed at reducing soil pollution.

5.3. Scientific Research

Scientists play a vital role in addressing environmental pollution through research, innovation, and the development of solutions. To reduce air pollution, scientists can focus on advancing clean energy technologies, such as developing more efficient and sustainable renewable energy sources and improving energy storage systems. They can contribute to the design and implementation of effective air quality monitoring systems, providing accurate data to guide policy decisions and public awareness campaigns. Additionally, research into air pollution's health impacts can inform public health interventions and support the development of cleaner transportation options.

In tackling water pollution, scientists can contribute by developing and implementing advanced wastewater treatment technologies to remove pollutants effectively. They can conduct research on the sources and transport of contaminants in water bodies, aiding in the formulation of targeted regulations. Furthermore, scientists can explore eco-friendly agricultural practices and water management strategies, helping to minimize nutrient runoff and pesticide pollution. By studying the ecological impacts of water pollution, scientists can contribute valuable insights into ecosystem resilience and restoration.

For soil pollution, scientists can work on developing remediation technologies to clean up contaminated sites. They can conduct extensive soil quality assessments, identifying pollution sources and understanding the long-term effects of various contaminants. By promoting sustainable agriculture practices through research, scientists can help mitigate soil degradation and reduce the use of harmful agrochemicals. Collaboration with policymakers is crucial to ensure that scientific findings are translated into effective regulations and land management practices.

6. Conclusion

As industrial processes release copious amounts of greenhouse gases, the Earth's delicate balance is disrupted, contributing to phenomena such as global warming and the emergence of acid rain. Rain now absorbs substantial carbon dioxide, rendering it acidic and posing threats to ecosystems. In the aspect of rivers and oceans, sewage and improper waste disposal transform pristine waters into receptacles of toxicity, jeopardizing the delicate balance of marine life. The plight of animals, exemplified by turtles ingesting plastic bags, underscores the urgency of addressing our disposal habits to safeguard biodiversity. Also, plant life will be affected since the release of sewage laden with nitrogen, phosphorus, and potassium becomes a precursor to ecological degradation. Excessive nutrients trigger algal blooms, choking water bodies and creating lifeless expanses colloquially known as "dead lakes" or "dead seas." In the aspect of land, the essay navigates the repercussions of

human activities on soil health. Desertification, deforestation, urbanization, and indiscriminate land lose have caused problems on land. Furthermore, the scars of mudslides, a consequence of imprudent infrastructure development, serve as a testament to the fragility of ecosystems when faced with human disregard in the past. In the future, scientists should be more focused on developing new technologies which are more sustainable, inventing more environmentally friendly fertilizers. Governments should try their best to limit the disposal of wastes and implementing more strict rules. Individuals should always follow the policies implemented by governments. This paper talks about how human factors affect the environment, and also proposes some possible solutions to those problems.

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